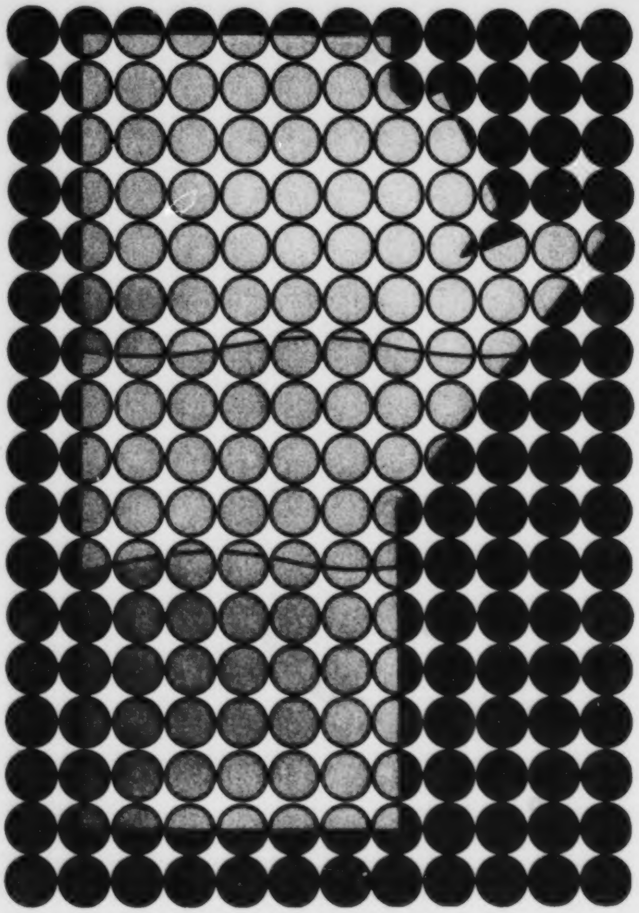

CANADA — MANITOBA
Soil Survey

Soils of the South Norfolk Municipality

Report D74

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SOILS REPORT NO. D74 1988

SOILS OF THE RURAL MUNICIPALITY OF SOUTH NORFOLK

by

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CANADA-MANITOBA SOIL SURVEY

AGRICULTURE CANADA

MANITOBA DEPARTMENT OF AGRICULTURE

DEPARTMENT OF SOIL SCIENCE, UNIVERSITY OF MANITOBA

PREFACE

This interim report and maps of the detailed (1:20,000 scale) and semi-detailed (1:50,000 scale) field and laboratory study of the soils of the Rural Municipality of South Norfolk is one in a series of such soil survey reports covering rural municipalities in southern Manitoba.

These reports reflect the growing concern by various government agencies that support the Canada-Manitoba Soil Survey, that a knowledge of the development and distribution of the soils of Manitoba is the key to understanding their properties, behavior and response to management. This concern requires that soils be described both in terms of their basic properties and the nature of the environmental setting in which they are found. Thus, when areas such as the Rural Municipality of South Norfolk require delineation of land of high or low value for crop production or for other uses, the basic reference document is an accurate and reliable soil map.

The land resource information included in this resurvey covers approximately 70 900 ha, with 14 100 ha of semi-detailed survey and 56 800 ha of detailed survey. It covers only a fraction of the land area covered in the former reconnaissance (1:125,000 scale) surveys of South Central Manitoba (Ellis and Shafer, 1943) and the Carberry Map Sheet Area (Ehrlich et. al., 1957).

However, the projected more intensive use of the soils for agriculture and the growing competition for other uses of land in the area has created a need for more up-to-date, more accurate and more detailed soil information. The increased examination of soils in the field, the use of current aerial photography, the use of improved methods of studying soils in the laboratory and the accumulated knowledge of the properties and uses of soils over the years, have all contributed to the additional information contained in this new series of reports and maps.

During the course of the resurvey of the Rural Municipality of South Norfolk large volumes of site specific soil data were generated that for practical reasons cannot be included in this interim report. These data are currently being input into the Canada Soil Information System (CanSIS) data bank. This computerized system of data management permits automated maniuplation and statistical evaluation of large volumes of data for soil characterization and interpretations. These data will shortly be available on request. In addition, the cartographic file of CanSIS provides a capability to produce derived maps of various kinds quickly and inexpensively. The types of derived maps that can be generated from the basic soil map include the sixteen interpretations that are provided in tabular form in this report as well as a number of single feature maps for such characteristics as drainage, texture of surface deposits, slope, stoniness and distribution of salinity. A package of interpretive maps and single feature derivative maps can be made available on request to: The Canada-Manitoba Soil Survey, Dept. of Soil Science, Rm. 362, Ellis Bldg., University of Manitoba, Winnipeg, Man. R3T 2N2.

The Canada-Manitoba Soil Survey trusts that this report and accompanying map will be of value to all individuals and agencies involved with the use of land within the map area.

ACKNOWLEDGEMENTS

This soils study was conducted as a joint project of the Canada Department of Agriculture, Manitoba Department of Agriculture and the Soil Science Department of the University of Manitoba.

The soils were mapped by: W. Fraser, L. Hopkins, M. Langman, G. Podolsky, I.G. Podolsky, E. St. Jacques and D. Swidinsky.

Laboratory analysis were provided by R. Mirza, K.C. Yeung and J. Madden under the direction of P. Haluschak.

Cartographic Services

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Manuscript review and soil correlation were provided by M. Langman, W. Michalyna, G. Mills and R. Smith.

Final typing of report manuscript provided by D. Sandberg.

HOW TO USE THIS SOIL REPORT

This soils report contains considerable information about the soils, their origin and formation, their classification and their potential for various uses such as dryland agriculture, irrigation, engineering and recreation. The report is divided into four parts: Part I provides a general description of the area; Part 2 describes the methodology used in the study; Part 3 discusses the development, scientific classification and morphological characteristics of the soils in the study area, and Part 4 provides an interpretation of soil properties and associated landscape features as they affect soil capability or suitability for various uses.

The soil map of the study area is compiled on an uncontrolled air photo base which is included in a pocket of the report folder. The map shows the distribution of soil types and associated landscape features that are significant for potential use as field management units. It provides a linkage from landscapes within the study area to the information contained in the report.

To assist the user in retrieving soil information quickly, the following steps are suggested:

If project consists of many individual maps, proceed with STEP 1., if only single map in pocket, proceed with STEP 2 to 6.

STEP 1 Consult the index to map sheets if the report contains many maps. Locate the areas of interest and note the map-sheet number(s) which identify the township and range on each map.

STEP 2 Consult the soil map in pocket of report folder. Locate the area(s) of interest on the map and identify the pertinent map unit symbols. Arabic numerals placed as superscripts following map symbols indicate the approximate proportion of each soil type within the map unit.

STEP 3 Consult the extended legend accompanying the soil map for an alphabetical listing of soil symbols giving the soil name, classification, drainage and related information concerning landforms, nature and depth of materials, and dominant vegetation.

STEP 4 For interpretive information about the soils, consult the appropriate Table in Part 4. Criteria utilized as guidelines in making these interpretations are provided in the Appendix.

STEP 5 Further information concerning the morphological properties and extent of the soils is presented in Part 3 where the soils are described alphabetically according to soil name.

STEP 6 Additional site-specific information not contained in this report is available on request from the Canada-Manitoba Soil Survey, Ellis Building, University of Manitoba.

SUMMARY

The Rural Municipality of South Norfolk is situated approximately 100 km west and slightly south of Winnipeg. This area was originally surveyed for soil resources commencing in 1936-1937 and was subsequently published in part in two reconnaissance scale (1:126,720) soil reports:

1. Report of the Reconnaissance Soil Survey of South-Central Manitoba, Report No. 4 (Ellis and Shafer, 1943). and,

2. Report of the Reconnaissance Soil Survey of Carberry Map Sheet Area, Report No. 7 (Ehrlich et. al., 1957).

Portions of South Norfolk were subsequently remapped at a detailed scale (1:20,000) and are published in two detailed soil reports:

1. Townships 9-8W, 9-9W and part of 9-10W were reported in Soils of the West Portage and MacGregor Map Areas, Report No. D-20 and D-44, (Michalyna et. al., 1982), and,

2. Twenty-one sections in and around the towns of Treherne, Rathwell and Notre Dame de Lourdes, were reported in Soils of the Rathwell, Treherne and Notre Dame Areas, Report No. D-52, (E. St. Jacques, 1984).

This detailed information has been reproduced in the current soil report exactly as it was originally published, with the exception of three sections south of Treherne and three sections at Notre Dame townsite which have been generalized to a semi-detailed scale (1:50,000).

Field mapping in the current project commenced in the summer of 1985 and was completed in the summer of 1986. The resurvey was conducted at a detailed scale (1:20,000) in the north and east, and at a semi-detailed scale (1:50,000) in the south and west of the municipality in response to different land-use patterns and intensities in these areas.

Surface deposits in the south and west consist dominantly of loam to clay loam textured, moderately calcareous till. Non-calcareous shale till is often found on more prominent ridges in close association with the dominant till. Interbedded gravels and sands occur with the tills in particular in the Pembina Escarpment. Still other till deposit areas are mantled by thin veneers and blankets of water-laid sediments which range in texture from silt to clay.

Surface deposits in the north and east of the map area consist dominantly of stratified lacustrine deposits. Textures range from loams to clays in the central portion of this area and become sandier in the extreme east and north. Sand deposits are generally shallow (<2 m) over loamy to clayey substrata. Surface deposits range in thickness from 30 m in the south and west to approximately 100 m in the north and east over shale bedrock.

Land use is influenced by the two dominant physiographic sections that occur in the map area. The level to slightly rolling landscape in the north and east, which is mapped in detail, occurs mostly in the loamy to clayey lacustrine deposits of the Red River Plain (Figure 3). Sandy deposits in the this area generally occur in the Assiniboine River Plain physiographic section. The agricultural potential of the clayey to loamy soils is generally good (CLI class 1-3) with well drained loamy soils on level land having the highest potential. Sandy soils in the area generally have a lower agricultural potential, ranging from good to poor (CLI class 3-5) mainly due to excessive or poor drainage and wind erosion hazards.

The hummocky to dissected landscape in the south and west of the map area, which is mapped in semi-detail, is composed dominantly of fine loamy till deposits from the Pembina Hills Upland and Escarpment physiographic sections. The agricultural potential of these deposits is generally good to poor (CLI class 3-5) due to a number of factors including steep topography, water erosion, stoniness and excessive drainage. Small undrained depressions among the hummocky uplands are generally unsuitable for agriculture (CLI class 6) due to poor drainage.

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PART 1

GENERAL DESCRIPTION OF THE STUDY AREA

1.1 LOCATION AND EXTENT

This report contains information of a soil survey of the Rural Municipality of South Norfolk covering approximately 70 912 hectares (Figure 1). The northern portion of South Norfolk, covering an area of approximately 56 832 ha, was mapped at a detailed scale of 1:20,000. The southern portion of the municipality, covering an area of approximately 14 080 ha was surveyed at a semi-detailed scale of 1:50,000. The Rural Municipality of South Norfolk covers all or parts of Townships 7-8W, 7-9W, 7-10W, 8-8W, 8-9W, 8-10W, 9-8W, 9-9W and 9-10W.

1.2 PRESENT LAND USE

Present land use is primarily agriculture with small areas of woodlot, quarries, urban development and recreation.

Below the Pembina Escarpment (Figure 3), on loamy to clayey deposits in level to gently rolling landscape, land use is dominantly intensive agriculture consisting of cereal grains, canola, corn and potatoes. The sandy deposits of lower agricultural potential in the east and north of the municipality are dominantly used for livestock, forage crops and woodlots.

Above the Pembina Escarpment in the south and west, dissected and hummocky landscapes, livestock, forage crops and woodlots are the dominant land-use. In areas of more gentle relief cereal crops, flax and canola production occupy a significant portion of the land area. In addition, significant areas of sand, gravel and shale bedrock are quarried in this area.

Considerable acreages of sandy deposits below the Escarpment are prone to wind erosion and require conservation practises such as wind breaks, reduction of summerfallow and use of stubble cover to minimize soil loss. Loamy and clayey soils along the escarpment and in hummocky or dissected landscapes are subject to water erosion and require conservation measures such as contour cultivation and permanently grassed gulleys.

The urban centers of Notre Dame de Lourdes, Rathwell and Treherne are located within South Norfolk and supply the agricultural service needs of the rural population of the Municipality.

1.3 RELIEF

Relief in the Rural Municipality of South Norfolk ranges from a high of approximately 500 metres above sea level in the south near the junctions of municipal roads 245 and 449, to a low of approximately 300 metres above sea level along the Assiniboine River Valley in the north of the map area (Figure 2). Approximate average elevations in the Municipality are 350 m.a.s.l. below the Escarpment in the north and east and 490 m.a.s.l. in the south and west.

Below the Pembina Escarpment in the north and east landforms are dominantly level (0.5 to 1.5%) to gently sloping (2 to 5%). Moderately (5 to 9%) to very strongly (31 to 45%) sloping topography occurs in localized duned areas or in areas dissected by the Assiniboine or Boyne Rivers and their tributaries.

Moderate to strongly (9 to 30%) sloping hummocky and ridged topography with enclosed depressions dominates above the Escarpment.

The Assiniboine River with its dissected valley walls and level terraces, traverses the northern part of the municipality in an east-west direction.

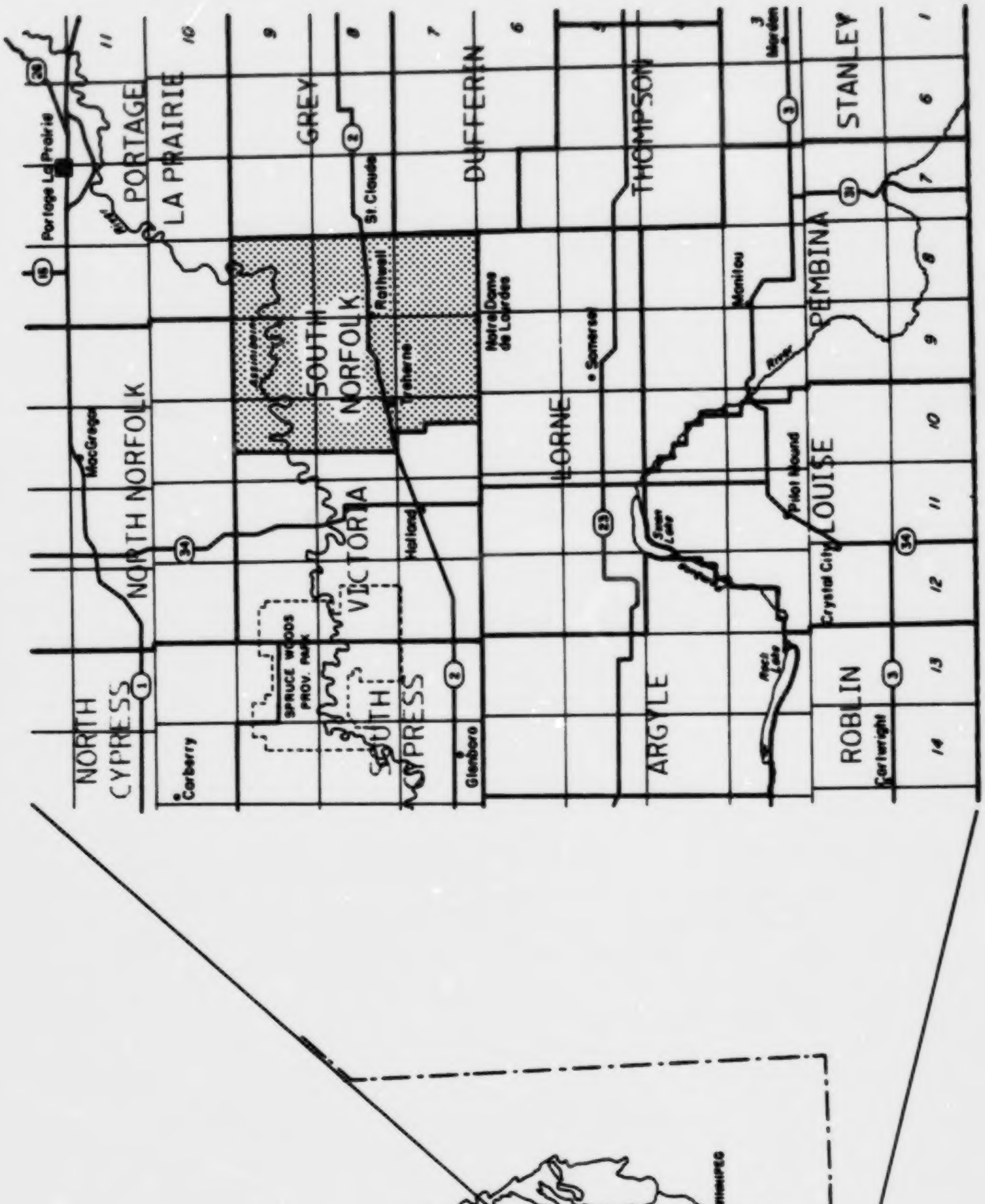
1.4 DRAINAGE: SURFACE AND SUBSURFACE HYDROLOGY

The northern third of the Rural Municipality of South Norfolk is drained by the Assiniboine River and its tributaries (Figure 2). The central and western portion of the map area north of the Escarpment is drained to the east and south by the Boyne River and its tributaries. The steeply sloping escarpment area which extends from southeast to west central through the municipality, is drained by numerous, short, small, intermittent streams. In the south and west where water movement is influenced by hummocky to undulating topography, drainage is rapid on upper slopes and often restricted in associated depressions. At the eastern edge of the map area surface drainage is often slow and subsurface water movement is restricted in the level sandy lacustrine sediments resulting in a high groundwater table. This is largely due to a large inflow of water from above the escarpment which runs off slowly in the level topography, and which infiltrates quickly through the sandy surface only to be restricted by a less permeable subsurface. However, intermittent creeks, sloughs and ditch drains in this area improve surface runoff.

1.5 PHYSIOGRAPHY

The Rural Municipality of South Norfolk occurs within the Saskatchewan Plain and Manitoba Plain physiographic divisions (Figure 3). The Saskatchewan Plain (E) includes most of the land area of the municipality. It is subdivided into the strongly hummocky morainic landscape of the Tiger Hills Upland (E2) and Pembina Hills Upland (E3) sections in the south, and the gently rolling lacustrine landscape of the Assiniboine River Plain (E9) section in the central and northern parts of the map area. The steep, east-facing escarpment area in the Pembina Hills Upland section is subdivided from the hummocky Pembina Hills thereby creating the Pembina Hills (E 3.1) and Pembina Escarpment (E 3.2) subsections. The Assiniboine River Plain (E9) section is subdivided into the gently rolling landscape of the Brandon Lakes Plain (E 9.4) and the hummocky to duned deltaic sands of the Upper Assiniboine Delta (E 9.5) subsections.

The Red River Plain (D1) section of the Manitoba Plain division has two subsections occurring along the eastern edge of the Rural Municipality of South Norfolk. The level to gently undulating deltaic sands of the Lower Assiniboine Delta (D 1.3) subsection occupy much of the eastern edge of the map area, and a small area of level lacustrine deposits from the Red River Valley (D 1.2) subsection occurs in the extreme southeast.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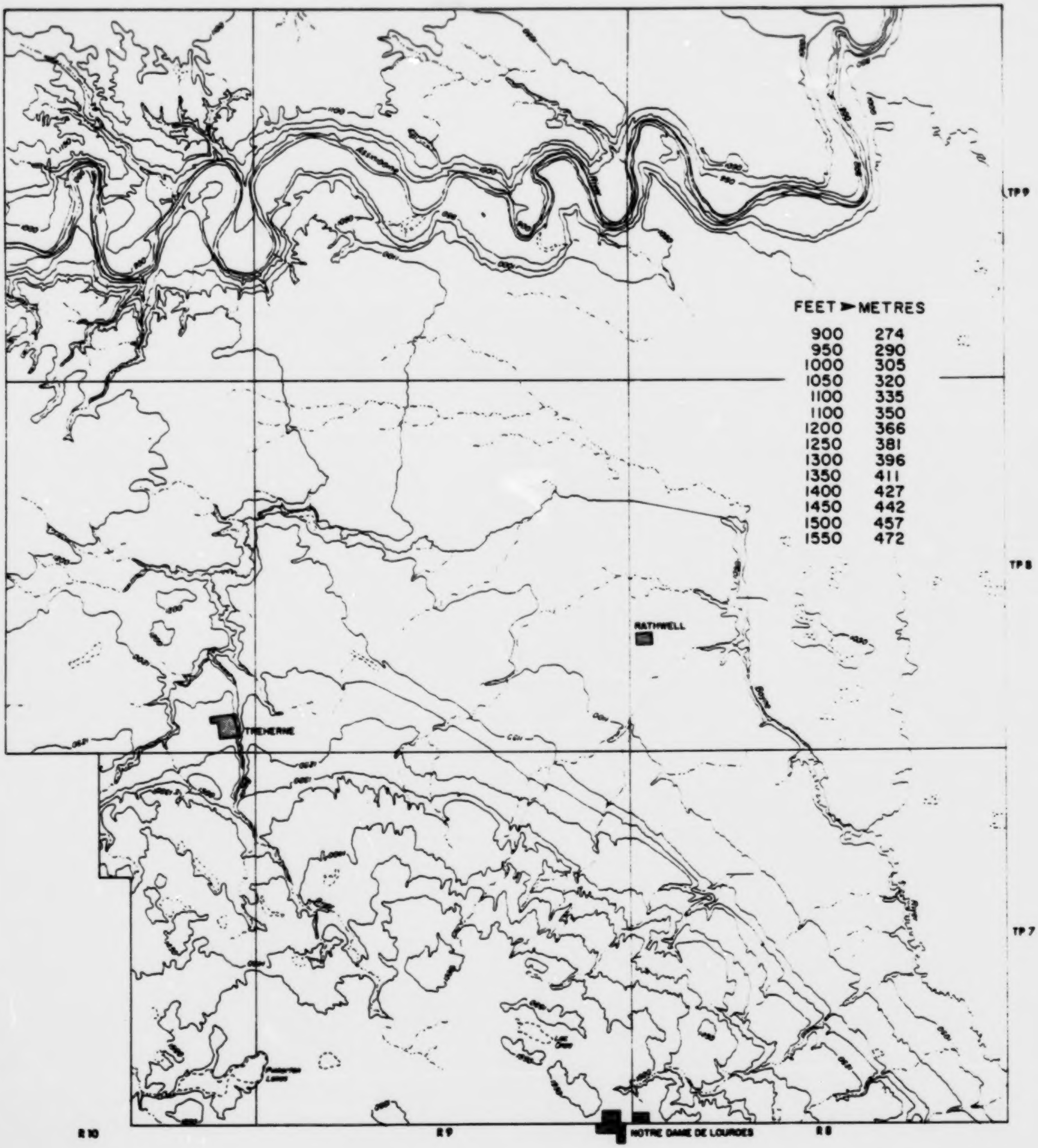
ROBLIN
LOUISE
PEMBINA
STANLEY
Portage La Prairie
MacGregor
Carberry
Glenboro
Holland
Treherne
Rathwell
St. Claude
Notre Dame de Lourdes
Somerset
Manitou
Pilot Mound
Crystal City
Cartwright
Morden
SPRUCE WOODS PROV. PARK
LAKE WINNIPEG
WINNIPEG
Brandon
Dauphin

Figure 1: Location Map of the South Norfolk survey area.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1400 427
1450 442
1500 457
1550 472
TP 9
TP 8
TP 7
RATHWELL
TREHERNE
NOTRE DAME DE LOURDES
R 10
R 9
R 8

Figure 2: Relief and Drainage map of the South Norfolk survey area.

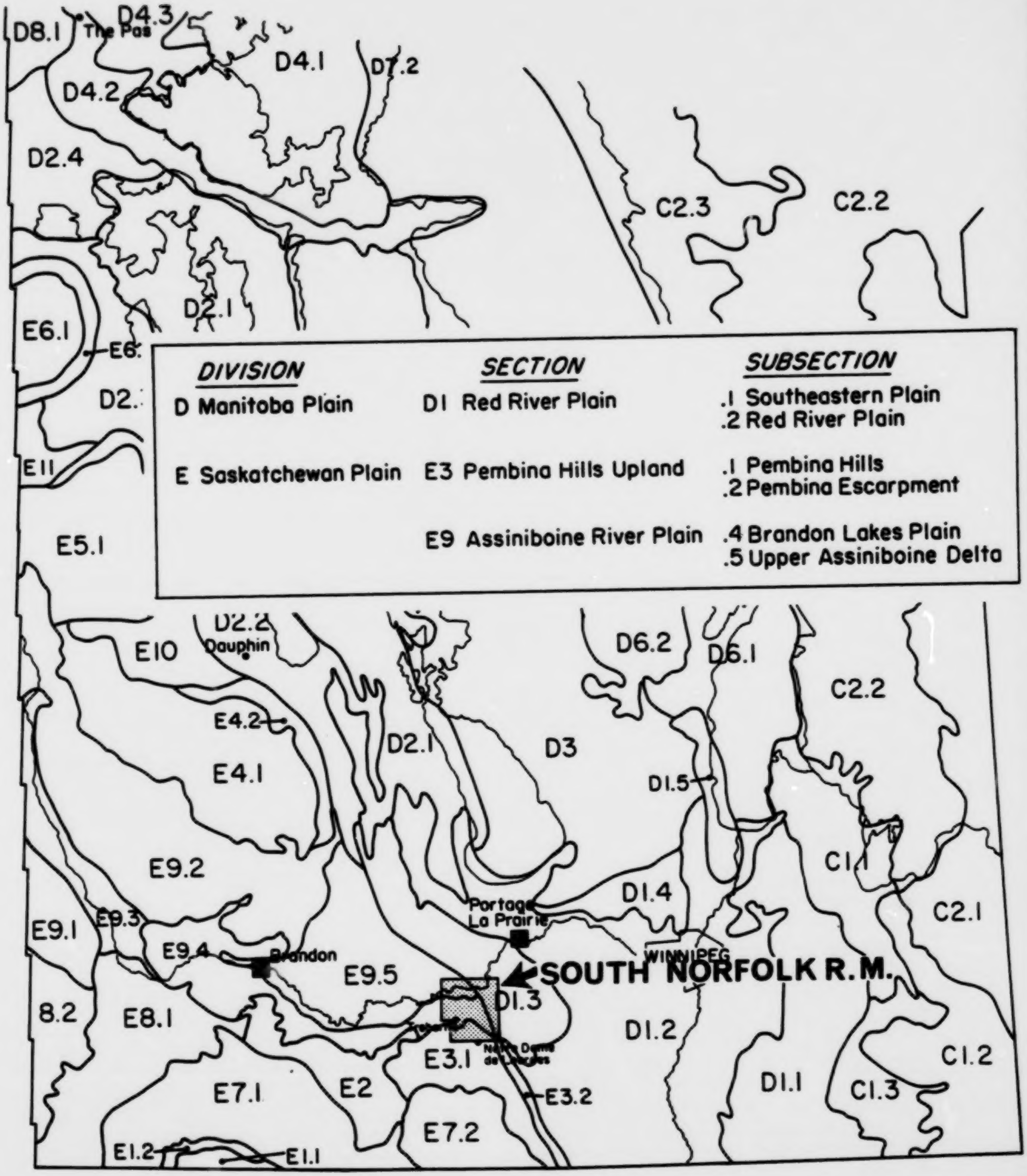

DIVISION
SECTION
SUBSECTION
D Manitoba Plain
D1 Red River Plain
.1 Southeastern Plain
.2 Red River Plain
E Saskatchewan Plain
E3 Pembina Hills Upland
.1 Pembina Hills
.2 Pembina Escarpment
E9 Assiniboine River Plain
.4 Brandon Lakes Plain
.5 Upper Assiniboine Delta
D8.1
The Pas
D4.3
D4.1
D7.2
D4.2
D2.4
C2.3
C2.2
D2.1
E6.1
E6.
D2.
E11
E5.1
D2.2
Dauphin
E10
D6.2
D6.1
C2.2
E4.2
D2.1
D3
E4.1
D1.5
E9.2
C1.1
D1.4
Portage La Prairie
C2.1
E9.1
E9.3
E9.4
Brandon
WINNIPEG
E9.5
SOUTH NORFOLK R.M.
D1.3
8.2
E8.1
D1.2
Treherne
Notre Dame de Lourdes
E3.1
C1.2
E7.1
E2
D1.1
C1.3
E3.2
E7.2
E1.2
E1.1

Figure 3: Physiographic map of the South Norfolk area.

1.6 GEOLOGY: BEDROCK AND SURFICIAL DEPOSITS

The underlying bedrock in the map area consists dominantly of various formations of shale from the Cretaceous Period of the Mesozoic Eras with minor areas of mixed shale, limestone and sandstone from the Jurassic Period of the Mesozoic Eras (Figure 4). Bedrock formations radiate in roughly concentric rings from the youngest formations in the southwest to the oldest in the northeast.

Siliceous Odanah shale of the Riding Mountain Formation occurs in the south of the map area beneath dominantly calcareous morainic till surficial deposits at less than 30 metres depth (Teller, 1976). The overlying till is extremely variable in thickness and composition, and is frequently interbedded with lacustrine silts or clays and glaciofluvial sands or gravels.

A variable thickness (<30 m deep) of dominantly sand and gravel beach surficial deposits is underlain by shales of the Vermilion River Formation in the escarpment area. These shales include non-calcareous Pembina shale, calcareous speckled Boyne shale and carbonaceous Morden shale. Calcareous shale from the Favel Formation lies at a depth of 30 to 60 m below loamy and sandy deltaic surficial deposits in the central portion of the map area. Dark gray carbonaceous shale from the Ashville Formation extends from the northwest to southeast at a depth of 60 to 90 m under variable textured lacustrine and deltaic surficial deposits. Sandstone from the Swan River Formation occurs in the north and east of the study area at a depth of 90 to 120 m beneath dominantly sandy deltaic and lacustrine surficial deposits. Siltstone and sandstone from the Amaranth Formation of the Jurassic Period lies at depths in excess of 100 m beneath lacustrine surficial deposits in the extreme east of the map area.

1.7 CLIMATE

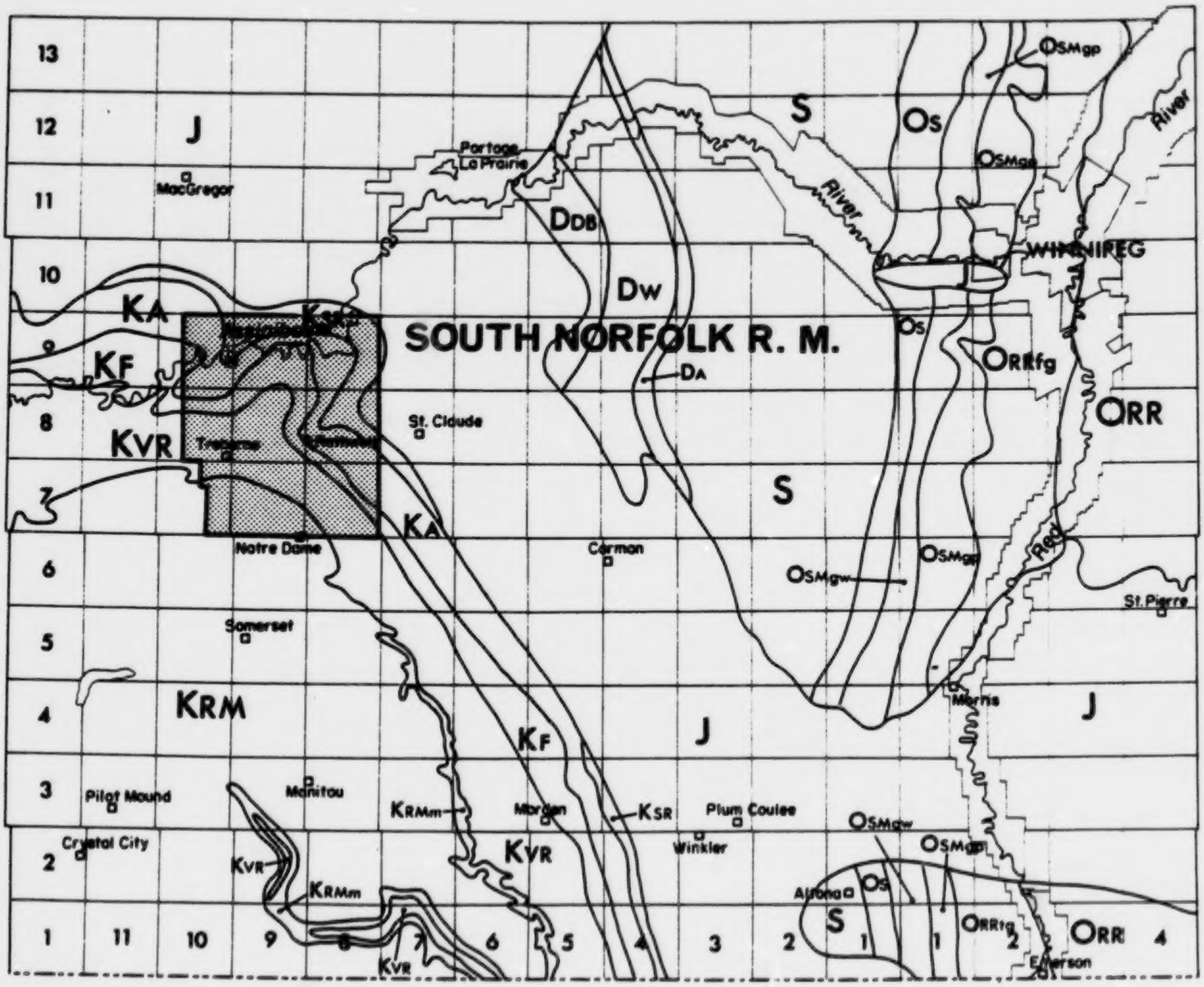
There are no continuous recording meteorological stations in the Rural Municipality of South Norfolk. There are, however, three meteorological stations in the vicinity of the municipality which can give some indication of climatic norms in the area. Cypress River and Glenboro meteorological stations are situated west of the Rural Municipality of South Northfolk in the gently undulating landscape north of the Pembina escarpment. Somerset meteorological station is south of the study area above the Pembina escarpment in an undulating morainic landscape.

Table 1 presents meteorological data based on annual means of monthly weather summaries for the years 1951 to 1980 inclusive. The Cypress River and Glenboro weather stations situated north of the escarpment generally record drier and warmer conditions than does Somerset situated south of the escarpment. Glenboro and Cypress River also have significantly more annual growing degree-days than does Somerset. However, Somerset records a longer frost-free period (> 0°C) than either of Cypress River or Glenboro.

1.8 VEGETATION

Agricultural development in South Norfolk has relegated most native vegetation to poorer soils or farm woodlots, windbreaks and stream beds. Remnant native vegetation is classified within the Aspen-Oak section of the Boreal Forest Region (Rowe, 1972). This section is defined as a broad transition zone where the boreal forest zone meets the grassland prairie. In the hummocky southern portion of the map area bur oak (Quercus macrocarpa) dominates the drier hill crests and slopes with a south-west aspect, while trembling aspen occurs on cool and moist north-east slopes or around wet depressions. The rolling deltaic deposits of the central portion of the map area are vegetated by tall prairie grasses and small bushy patches of trees including trembling aspen, green ash (Fraxinus nigra) and Manitoba maple (Acer negundo).

The droughty deltaic sands and Assiniboine River Valley found in the north of the map area support forest stands of bur oak, white spruce (Picea glauca) and poplar with trembling aspen and hazelnut (Corylus cornuta) in locally moist areas.


13
12
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7
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1
J
MacGregor
Portage La Prairie
S
Os
OsMgp
River
DDB
Dw
WINNIPEG
KA
KSR
KF
KVR
SOUTH NORFOLK R. M.
DA
Os
ORRfg
ORR
St. Claude
Treherne
S
KA
Notre Dame
Carman
OsMgw
OsMgp
Red
St. Pierre
Somerset
KRM
J
Morris
J
KF
Pilot Mound
Manitou
KRMm
Morden
KSR
Plum Coulee
OsMgw
Crystal City
Winkler
KVR
OsMgp
KVR
KRMm
Altona
Os
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ORRfg
ORR
Emerson
KVR
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2
4

MESOZOIC

Cretaceous

Upper Cretaceous

KRM Riding Mountain Formation (285-340 m): Millwood Member (m) - soft greenish bentonitic shale. Odanah Member (o) - hard grey siliceous shale. Coulter Member (c) - soft grey bentonitic clayey siltstone and shale.

KVR Vermillion River Formation (50-190 m): Morden Member - black carbonaceous shale Boyne Member - grey calcareous speckled shale and carbonaceous shale. Pembina Member - thinly interbedded carbonaceous shale, bentonite and bentonitic shale.

KF Favel Formation (15-45 m): calcareous speckled shale ("Second Specks"); minor limestone, bentonitic and "oil shale".

Upper and Lower Cretaceous

KA Ashville Formation (55-115 m): dark grey carbonaceous shale, in part bituminous; minor sand, silt and bentonite. (Local occurrence of thick bar-type sandstone in subsurface-Ashville or Viking Sand).

Lower Cretaceous

KSR Swan River Formation (0-105 m): sandstone, in places glauconitic; kaolinitic shale, minor lignite. May include some non-marine Jurassic beds in the north. Also includes channel and/or karst fill within Paleozoic outcrop belt. Locally missing from outcrop sequence due to non-deposition.

Figure 4: Geology Map of the Rural Municipality of South Norfolk.

TABLE 1

Climatic Data from Weather Stations in the Vicinity of the Rural Municipality of South Norfolk

	Cypress River	Glenboro	Somerset
Elevation (m)	375	373	496
Mean Annual Rainfall (mm)	388.4	390.6	400.1
Mean Annual Total Precipitation (mm)	521.2	523.3	546.8
Mean Annual Daily Maximum Temperature (°C)	8.2	8.5	7.2
Mean Annual Daily Minimum Temperature (°C)	-3.6	-4.1	-3.6
Mean Annual Daily Temperature (°C)	2.3	2.4	1.8
Frost-free Period (days)	116	117	125
Average Date of Last Frost (Spring)	May 24	May 21	May 19
Average Date of First Frost (Fall)	Sept. 18	Sept. 16	Sept. 22
Mean Annual Growing Degree-Days	2732	2749	2632

Environment Canada, 1982. Canadian Climatic Normals; Vol. 2 Temperature, Vol. 3 Precipitation, Vol. 4 Degree-Days, Vol. 6 Frost, Atmospheric Environment Service.

PART 2

METHODOLOGY

2.1 MAPPING AND MAP SCALE

Semi-detailed (1:50,000 scale) soil mapping was conducted south of the Manitoba Escarpment in townships 8-8W, 8-9W and 8-10W. This map scale requires that inspections be made to at least one meter depth along road allowances and trails resulting in an inspection density of approximately one observation/30 ha. Therefore certain minor soils or phases may not be encountered during field investigations and thus become part of the unnamed inclusions of the map. Generally, the proportion of unidentified inclusions increases as inspection density decreases or as natural soil variability increases. Cartographic limitations of semi-detailed maps also prevent the delineation of any feature smaller than 12.5 ha in area (Mapping System Working Group, 1981).

Semi-detailed soil maps provide soil information which can be used for many purposes including local or regional planning (Mapping Systems Working Group, 1981). Semi-detailed mapping was utilized in this area because of current landuse patterns and because of predicted future landuse.

Detailed (1:20,000 scale) soil mapping was conducted north of the Manitoba Escarpment. This mapping was produced by examining soils to at least one meter depth at approximately 150 meter intervals along two traverses per section as well as at every 0.4 km along road allowances. The resulting inspection density is approximately one observation per 10 ha. Therefore most soils and many phases are encountered during field observations and become identified components of map delineations. Generally, there are fewer unidentified inclusions in a detailed map than in a semi-detailed map when comparing the same level of natural soil variability. Cartographic limitations of detailed maps prevent the delineation of any feature smaller than 6.25 ha in area (Mapping Systems Working Group, 1981).

Detailed soil maps provide soil information which can be used for many purposes from broad regional planning to "farm-gate" decisions. Detailed mapping was utilized in this area because current intensive landuse patterns and anticipated future landuse concerns require a detailed and reliable soil resource map.

Detail surveys proceed at approximately 256 ha per field-man-day, while semi-detailed surveys cover roughly 512 ha per field-man-day. Therefore, detail surveys are more time consuming and more costly to produce than semi-detailed surveys. Subsequently, detailed surveys are only conducted in areas where intensive and highly reliable soil information is needed for landuse decisions.

2.2 MAP UNITS

A map represents mappable portions of the soil landscape that together have characteristics and properties varying within more or less narrow limits that are determined by the intensity of the survey. A map unit contains predominantly one or more than one soil or non-soil individual plus a certain proportion (varying within prescribed limits) of unnamed and undescribed inclusions. They are delineated on the basis of the types and relative proportions of their soils or non-soils, as well as on the basis of external criteria such as slope, stoniness or erosion.

Soil maps show the distribution of kinds of soils and, as such, serve as a link so that the knowledge gained in one locality about the usefulness or behavior of a kind of soil can be extended to other bodies of the same soil.

A map unit comprises all delineations that contain exactly the same symbol. This includes all the characters denoting soils, nonsoils, phases and deciles while they represent real portions of the landscapes, most map units are concepts because their total range of properties is made up of the aggregate of all their delineations and no one delineation will contain the full range of properties. The proportions of each of the component soils and nonsoils and undescribed inclusions may vary within reasonable units from one delineation to another.

A map unit is named from its principal component soils or nonsoils. It is described in terms of the properties of these components, their relative proportions and other external land attributes. In this project, units are described in terms of named soil series and phases of soil series.

The soil series is defined as a naturally occurring soil body such that any profile within that body has a similar number and arrangement of horizons whose colour, texture, structure, consistence, reaction and composition are within a narrowly defined range.

Map units will always contain small proportions of inclusions. These inclusions may be soil or nonsoil mapping individuals that are named and have their own map units elsewhere in the survey, or soils or non-soils that are not recognized and named at all in the survey. They may, however, be mentioned in the description of soil types in the report.

2.3 SIMPLE AND COMPOUND MAP UNITS

There are two major types of map units, simple and compound. The difference between them is defined in terms of the proportion and contrast of their components.

A Simple Map Unit contains predominantly one soil or nonsoil. The proportion of its components vary according to their areal extent and contrasting characteristics as they may affect soil management or use.

Its components vary as follows: the predominant component comprises at least 65 percent with up to 35 percent of nonlimiting, similar components (components are alike in most properties and behaviour), or up to 25 percent of nonlimiting dissimilar components (components do not affect management of the map unit but does have a significant number of properties that vary from the predominant to component), or up to 15 percent of limiting, dissimilar components (components have many constrasting properties and usually affect management differently).

A Compound Map Unit contains predominantly two soils or non-soils (or a combination of both). The proportions of the two major components may vary from one considerably exceeding the other to both being approximately equal. Complementary to the definition of a single map unit, the proportions of its components vary according to their areal extent and contrasting characteristics. As they may affect soil management or use its major components vary as follows: if other components are similar and nonlimiting no single component represents more than 65 percent; or if other components are dissimilar and nonlimiting no single component represents 75 percent; or if other components are dissimilar and limiting no single compónent represents 85 percent.

A soil or non-soil may occur in more than one compound unit. The complex nature of soil landscapes requires that the surveyor be allowed the freedom to describe their combinations as they occur. For the purpose of describing compound map units, components are considered dominant if they occupy over 40 percent of the unit significatn from 15-40 percent and minor if they occupy less than 15 percent. Minor components are described only if they are highly contrasting.

2.4 PHASES

It is frequently desireable to indicate by map unit symbol, a condition or quality of soil property or landscape feature that deviates significantly from the normal definitions of map units. These indicated variations or phases of soil properties and landscape features, varying from delineation to delineation, significantly affect soil behavior and land management or rise.

It is not always easy to maintain a clear distinction between a soil phase and a land phase. Soil properties that are frequently used as phase criteria include texture depth, surface peat, salinity and physical disruption. Properties of land that are used include slope, wind and water erosion, stoniness, inclusiveness and altered drainage.

In this study the effect of four properties and land features are shown as a character in the denominator of the map unit symbol and described outside the main soil map legent. The four properties and features are erosion slop class, degree of stoniness and salinity. The degree or magnitude of each is designated in the following manner;

Erosion

x - none-eroded or minimal
1 - weakly eroded
2 - moderately eroded
3 - severely eroded
O - overblown

Slope Class

x - 0 to 2% level to nearly level
c - 2 to 5% very gently sloping
d - 5 to 9% gently sloping
e - 9 to 15% moderately sloping
f - 15 to 30% strongly sloping
g - 30 to 45% very strongly sloping
h - 45 to 70% extremely sloping

Stoniness

x - non stony
1 - slightly stony
2 - moderately stony
3 - very stony
4 - exceedingly stony
5 - excessively stony

Salinity

x - non saline (0-4 mS/cm)
s - slightly saline (4-8 mS/cm)

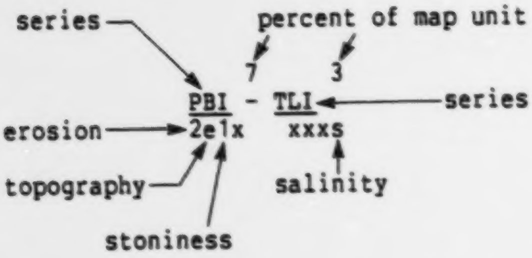
t - moderately saline (8-15 mS/cm)
u - strongly saline (>15 mS/cm)

The convention employed to indicate these features in the map symbol is as follows:

If none of the above properties are observed to be significant, the map symbol representing the normal or unaffected soil series is used alone without modifiers.

If one or more phase features are recognized, the appropriate letter or number is placed below the soil series symbol in one of four designated locations in the map unit symbol. The designated order is erosion, slope class, stoniness and salinity. If a particular feature is not observed to be significant, an x is used in its appropriate designated location in the map symbol.

For example, the compound map unit coded:



Decoding of this symbol explains that an estimated 70 percent of this compound map unit contains Pembina soils (PBI) on moderately eroded (2), 9 to 15 percent slopes (e) which are slightly stony (1); and approximately 30 percent of the map unit is slightly saline(s) Tellier soils on level, non-eroded, non-stony land.

Detailed definitions for erosion, topography, stoniness and salinity phase classes are given in the Glossary (Appendix A).

2.5 SAMPLING

During the course of field investigations and mapping, selected surface and subsurface soil samples were collected for laboratory analysis. These samples were used as bench mark references for specific soil attributes, and to assist in general soil characterization. Detailed soil sampling, description and laboratory analysis was performed on selected modal soil sites to provide examples of common soil physical and chemical characteristics in the study area. Results of these analyses can be obtained by contacting the Canada-Manitoba Soil Survey at the address listed in the Preface to this report. Figure 5 shows the location of the detailed soil sample sites in or near the Rural Municipality of South Norfolk.

An intensive physical and chemical characterization was conducted at these sites to an average depth of 1 to 1.5 m. Field evaluations commonly included:

- soil classification
- soil colour
- soil horizonation
- soil structure
- soil drainage/water table characteristics
- clay films
- concretions, nodules and cast descriptions
- root description
- landscape features and landuse
- stoniness and rockiness
- soil erosion

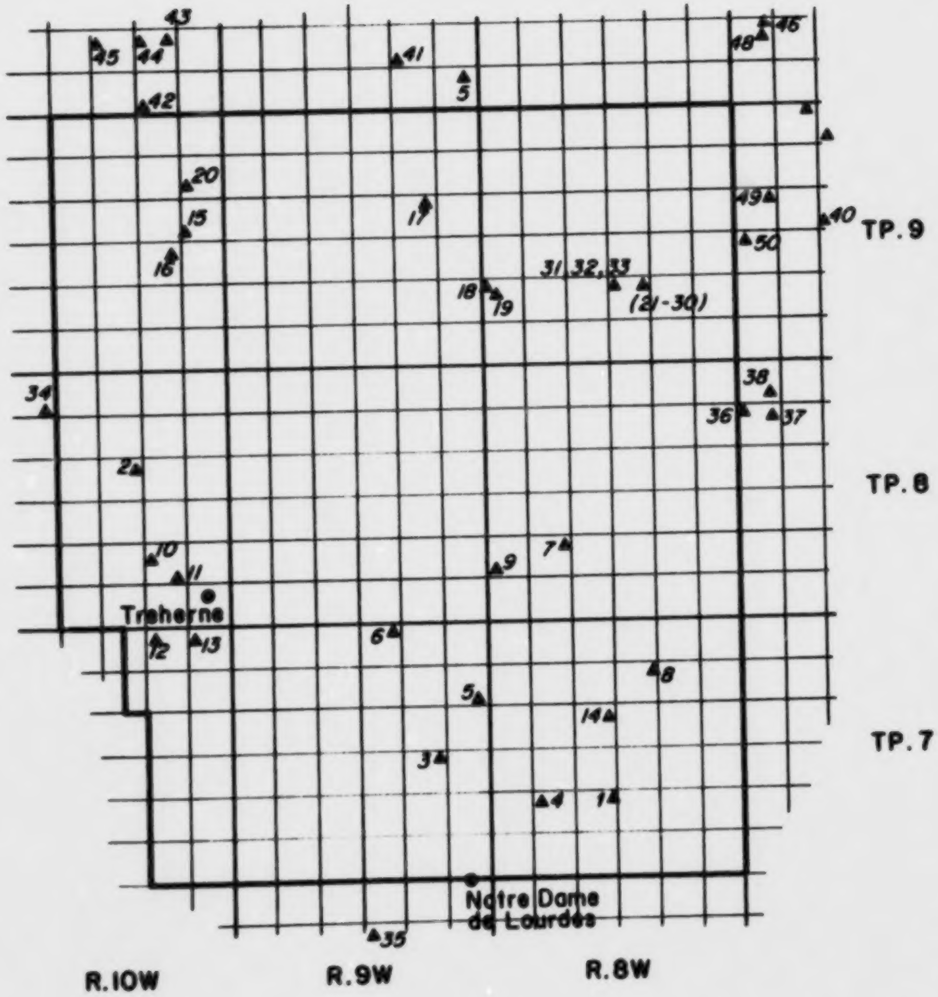
Laboratory evaluations commonly included:

- pH
- organic carbon
- total N
- calcium carbonate equivalent
- calcite and dolomite
- cation exchange capacity
- exchangeable cations

- extract determinations
  - calcium
  - sodium
  - manganese
  - chloride
- nitrate - N
- particle size analysis
- bulk density
- atterberg limits
  - plastic limit
  - liquid limit
- shrinkage limit
- moisture content

Additional specialized laboratory or field analyses were performed on some profiles to access specific soil attributes.

Soils suspected of being sufficiently saline to inhibit agricultural potential were sampled at depths of 10 to 25 cm, 50 to 60 cm and 100 to 120 cm. These samples were analyzed for electrical conductance and soluble salt content in order to characterize soil salinity.



Sample Site No.	Series Name	Location	Sample Year
1	Leary	NE9 7-8W	1985
2	Fairland	NE22 8-10W	1985
3	Firdale	NE14 7-9W	1985
4	Kingsley	NW8 7-8W	1985
5	Marringhurst	SE25 7-9W	1986
6	Dorset	NE34 7-9W	1986
7	Elm Creek	NE8 8-8W	1983
8	Dobbin	NE27 7-8W	1983
9	Rignold	SW7 8-8W	1983
10	Prodan	NW11 8-10W	1983
11	Durnan	SE11 8-10W	1983
12	Bishop	NW35 7-10W	1983
13	Altamont	NW36 7-10W	1983
14	Blumenort	NE21 7-8W	1983
15	La Salle	SW24 9-10W	1978
16	Croyon	NE14 9-10W	1978
17	Firdale	NE23 9-9W	1978
18	Kronstal	NW7 9-8W	1978
19	Reinfeld	NW7 9-8W	1978
20	Dobbin	SW25 9-10W	1978
21	Skelding	NE10 9-8W	1981
22	Longplain	NE10 9-8W	1981
23	Longplain	NE10 9-8W	1981
24	Longplain	NE10 9-8W	1981
25	Willowcrest	NE10 9-8W	1981
26	Willowcrest	NE10 9-8W	1981
27	Lelant	NE10 9-8W	1981
28	Almasippi	NE10 9-8W	1981
29	Willowcrest	NE10 9-8W	1981
30	Lelant	NE10 9-8W	1981
31	Longplain	NW10 9-8W	1981
32	Almasippi	NW10 9-8W	1981
33	Lelant	NW10 9-8W	1981
34	Halstead	SE32 8-10W	1986
35	Tadpole	NW27 6-9W	1984
36	Winkler	NW30 8-7W	1983
37	Rosebank	NE30 8-7W	1983
38	Layland	SE31 8-7W	1983
39	Gnadenthal	SW33 9-7W	1982
40	St. Claude	SW21 9-7W	1982
41	St. Claude	SW11 10-9W	1978
42	Shilox	SW2 10-10W	1978
43	Halstead	NE11 10-10W	1978
44	Halstead	NW11 10-10W	1978
45	Dobbin	NW10 10-10W	1978
46	Lelant	NE7 10-7W	1978
47	Neuenberg	NE32 9-7W	1978
48	Longplain	NE7 10-7W	1978
49	Almasippi	NE19 9-7W	1978
50	Perillo	NW18 9-7W	1978
51	St. Claude	NE1 10-9W	1978

Profiles numbered 1 to 33 inclusive were samples within the municipal boundaries of South Norfolk. Profiles numbered 34 to 51 inclusive were samples in close proximity to the Rural Municipality of South Norfolk.

Figure 5: Location of Detailed Soil Sample Sites in or Near the Rural Municipality of South Norfolk.

PART 3

DEVELOPMENT, CLASSIFICATION AND MORPHOLOGY OF SOILS

3.1 SOIL CLASSIFICATION AND DEVELOPMENT

The principal factors affecting soil formation are climate, vegetation, parent material, relief and drainage. The interaction of these soil forming factors is expressed in the morphological characteristics of soil. Through observation of these characteristics, it is possible to classify soils into natural units and to infer their genesis or the processes involved in their formation.

The relationships existing between climate, vegetation and soil in Manitoba are reflected in the Ecoclimatic regions identified and defined by the Canada-Manitoba Soil Survey (unpublished data). The Rural Municipality of South Norfolk is located dominantly in the Grassland Transition ecoclimatic region of the Grassland ecoprovince (Gt) (Figure 6). This ecoclimatic region ranges in soil climate from Boreal cool to moderately cool subhumid conditions. In South Norfolk the atmospheric climate of the Grassland Transition is relatively cool and dry in the west of the municipality (subregion Gt_2), gradually shifting to warmer and more moist conditions with a longer frost-free period in the east (subregion Gt_4).

Soils of the Grassland Transition are dominantly Black Chernozems developed on calcareous sandy to clayey lacustrine sediments and loamy till deposits. However, in (subregion Gt_2) outliers of Degraded soils characteristic of Boreal environments occur in locally more humid, steep landscapes. These soil outliers are dominantly Dark Gray Chernozems. Poorly drained sites are common and are characterized by Humic Gleysols. Saline soils, although of local importance are minor in extent.

The southern portion of the municipality occurs within the Low Boreal, subhumid ecoclimatic region (LBs_2), subregion two of the Boreal ecoprovince. This ecoclimatic region is characterized by a Cryboreal moderately cold subhumid soil climate. Dark Gray Chernozemic soils have developed on upland sites reflecting the influence of vegetation that is transitional between grasslands in lower elevations to the north and the boreal forest in higher elevations. Poorly drained sites are characterized by shallow peaty surface layers on Humic Gleysol soils.

3.2 GENERALIZED SOIL MAP AND SOIL RELATIONSHIPS

Many diverse soil types occur often in extremely complex associations within the Rural Municipality of South Norfolk. Figure 7 is a schematic north-south cross-section through the municipality illustrating some of the common landscapes and surficial geology, and relating these to typical soils found within the area.

Dominantly Dark Gray Chernozem and Dark Gray Luvisol soils develop in the morainic tills which outcrop on hummocky landscape in the southern part of municipality. Dark Gray and Black Chernozem soils develop in beach sands and gravels, or in lacustrine veneers over beach deposits, along the lower slopes of the Pembina Excarpment. Black Chernozem soils are dominant on the gently rolling, variable textured glaciolacustrine deposits in the central portion of the map area although Dark Gray Chernozems can occur in locally more humid areas on dissected landscapes adjacent to the Assiniboine River and Manitoba Escarpment. Black Chernozem and Regosol soils occur in the glaciolacustrine sands found in the gently rolling north-central portion of the Rural Municipality of South Norfolk. Dark Gray and some Black Chernozem soils, develop on hummocky and dissected glaciolacustrine silts and loams in the north of the municipality. Regosol soils are found in the recent alluvial deposits along the Assiniboine River. Regosol soils dominate on the hummocky duned, eolian sand deposits in the north of the map area.

Figure 8 is a 1:250,000 scale generalized soils map depicting the regional distribution of soil groupings. Soil groups are derived from areas of similar major diagnostic soil characteristics such as drainage, parent material and taxonomy at the Great Group level. The soil group name assigned to each map delineation is generalized from the dominant soils identified in the area on the detailed or semi- detailed soil maps. Soil phases, subdominant components of compound map units and small soil areas are not recognized on the generalized soils map.

The generalized soil map provides an overview of general soil distribution for the Rural Municipality of South Norfolk on one map sheet. This map is useful for broad-scale planning such as regional agricultural planning, regional engineering and recreational planning or for municipal development plans.

3.3 SOIL SERIES DESCRIPTIONS

Soil series are listed in alphabetical order and include descriptions of the genetic soil profile, texture, parent material, drainage, surface runoff, permeability, topography and landuse. Additional information includes a listing of closely associated soils and similar soils with a brief description of their differentiating features. Each soil profile has a range of soil characteristics within the limits diagnostic of the series after which it is named. Information pertaining to the suitability and management of each soil for agriculture, engineering uses or recreational applications is presented in Part 4 of this report.

Table 2, provides an abbreviated reference showing the relationship among soil drainage, parent material, taxonomy and soil series name. A more comprehensive presentation of this data is in Table 3.

The soils information in these Tables reflects the influence of ecoclimatic subregions occurring in South Norfolk. Soils east of the Pembina Escarpment develop in a Grassland transition subregion (Gt_4). This relatively warm and moist subregion promotes the development of dominantly Black Chernozems. Soils west of the Manitoba Escarpment develop in either a relatively cool and dry Grassland transition subregion (Gt_2), or in a Low Boreal, subhumid subregion (LBs_2). The soils of these two subregions are combined in the soils legends because of their physiographic proximity, and because the Grassland transition (Gt_2) in this area has outliers of LBs_2-like, Dark Gray Chernozemic soils in locally more humid sites.

Ecoclimatic Region[1]	Sub-region[2]	Dominant Soils	Soil Climate		Vegetation Zone
			Temperature Class	Moisture Subclass	
GRASSLAND TRANSITION	Gt 1,2,3,4	Chernozemic Black, Gleysols	Boreal, cool to moderately cool	Subhumid	Grassland and Aspen Parkland
LOW BOREAL subhumid	LBs 1,2	Chernozemic Dark Gray, Brunisolic, Organic	Cryoboreal, moderately cold	Subhumid	Grassland-forest transition
LOW BOREAL, subhumid transition		Brunisols, Luvisols Chernozemic Dark Gray, Gleysols, Organic	Cryoboreal, moderately cold	Humid to subhumid	Mixed Deciduous - Coniferous Forest
MID BOREAL, subhumid	MBs 1,2, 3,4	Luvisolic, Brunisols, Organic	Cryoboreal, moderately cold	Subhumid to humid	Mixed Deciduous -Coniferous Forest

[1] Ecoclimatic Regions of Manitoba. Canada-Manitoba Soil Survey, 1985. Unpublished data, revised, 1987.

[2] Subregions reflect climatic influence which is expressed in local soil and vegetation relations and which affect land use, management and potential biomass production.

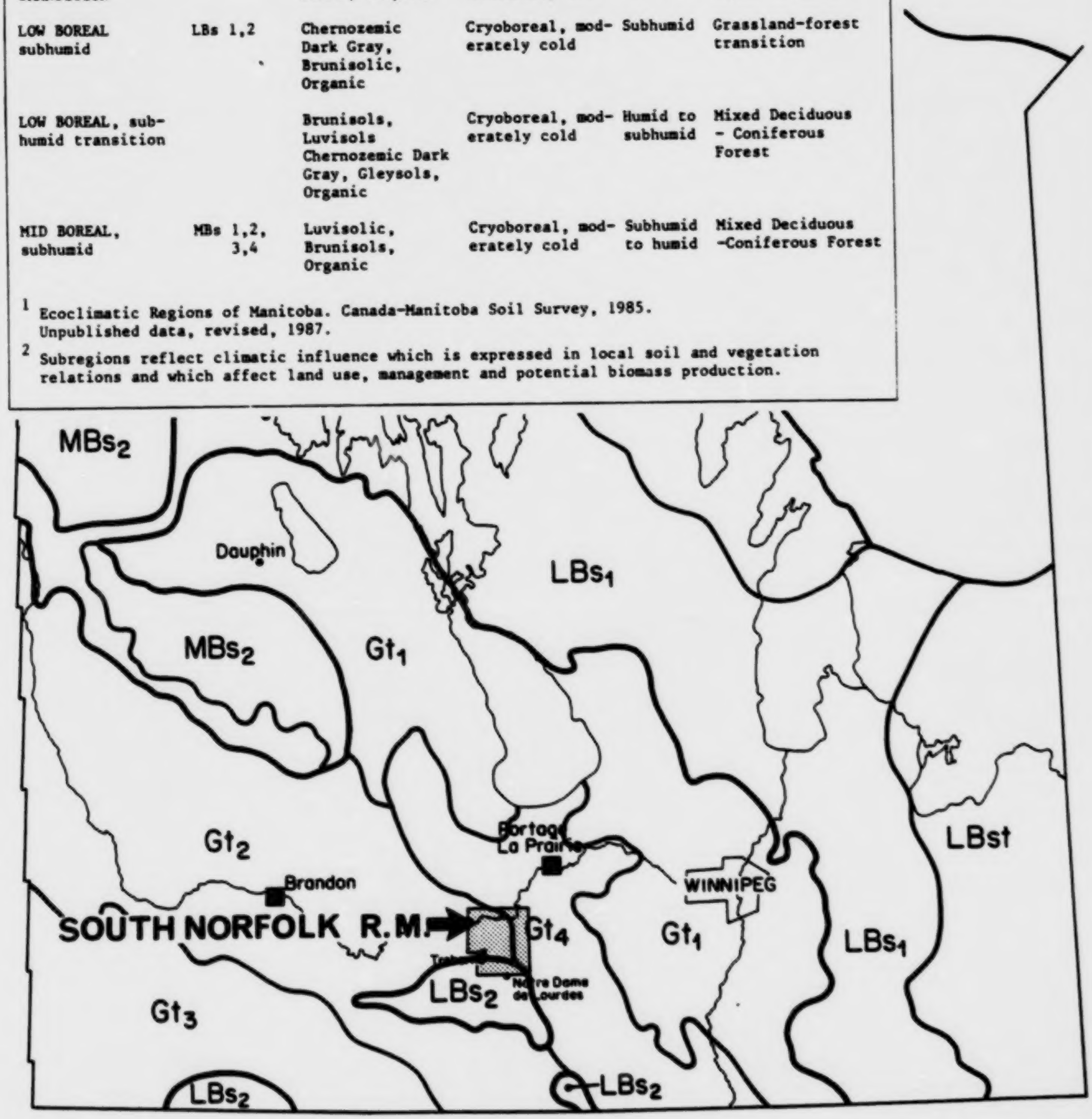

MBs2
Dauphin
LBs1
MBs2
Gt1
LBst
Portage La Prairie
Gt2
Brandon
WINNIPEG
SOUTH NORFOLK R.M.
Gt4
Gt1
LBs1
Treherne
Notre Dame de Lourdes
LBs2
Gt3
LBs2
LBs2

Figure 6: Ecological Regions of the Study Area.

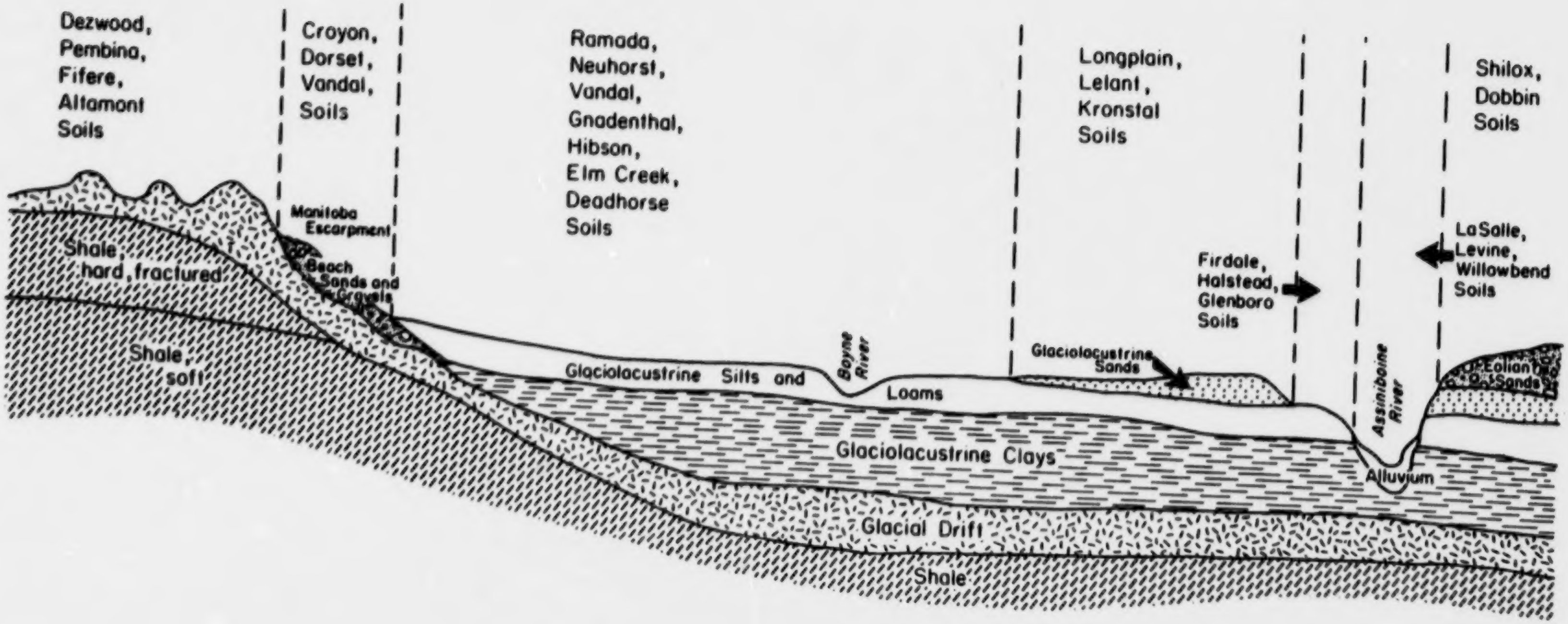
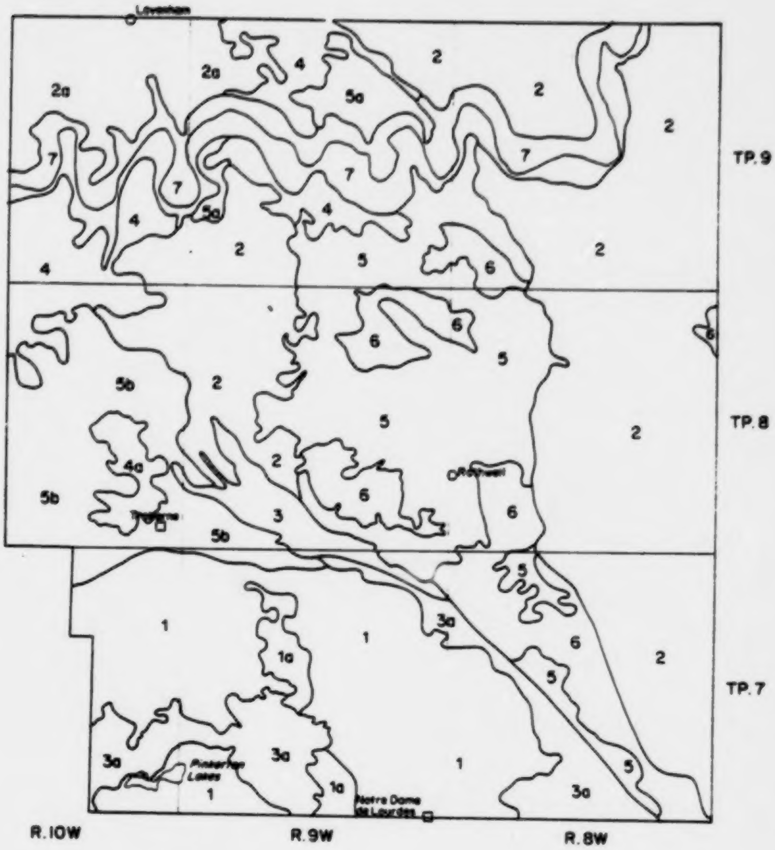

Dezwood,
Pembina,
Fifere,
Altamont
Soils
Croyon,
Dorset,
Vandal,
Soils
Ramada,
Neuhorst,
Vandal,
Gnadenthal,
Hibson,
Elm Creek,
Deadhorse
Soils
Longplain,
Lelant,
Kronstal
Soils
Shilox,
Dobbin
Soils
Firdale,
Halstead,
Glenboro
Soils
LaSalle,
Levine,
Willowbend
Soils
Manitoba Escarpment
Beach Sands and Gravels
Shale, hard, fractured
Shale, soft
Glaciolacustrine Silts and Loams
Boyne River
Glaciolacustrine Sands
Assiniboine River
Eolian Sands
Glaciolacustrine Clays
Alluvium
Glacial Drift
Shale

Figure 7: Cross-Section of the Rural Municipality of South Norfolk.


Lavenham
2a
2a
4
5a
2
2
2
7
7
7
7
5a
4
4
2
5
6
2
4
TP.9
6
6
5
5b
2
5
2
TP.8
4a
2
Rathwell
5b
6
6
Treherne
3
5b
5
1
3a
1
6
1a
5
2
TP.7
3a
Pinkerton Lakes
3a
1
1
1a
Notre Dame de Lourdes
3a
5
R.10W
R.9W
R.8W

Map Symbol	Soil Group	
1	Pembina Soils	Dominantly mixed calcareous till soils or thin lacustrine mantle over till substrates.
1a	Fifere Soils	Dominantly non-calcareous shale derived till soils.
2	Long Plain Soils	Dominantly imperfectly drained stable sandy soils.
2a	Dobbin Soils	Dominantly well drained sandy soils occurring in duned landscapes.
3	Dorset Soils	Dominantly Black soils developed on a thin loamy mantle over gravelly outwash deposits.
3a	Croyon Soils	Dominantly Dark Gray soils developed on a thin loamy mantle over gravelly outwash deposits.
4	Halstead Soils	Dominantly Dark Gray soils developed on loamy to coarse loamy lacustrine deposits.
4a	Fairland Soils	Dominantly Black soils developed on loamy to coarse loamy lacustrine deposits.
5	Neuhorst Soils	Dominantly Black soils developed on fine loamy lacustrine deposits.
5a	Firdale Soils	Dominantly Dark Gray soils developed on fine loamy lacustrine.
6	Winkler Soils	Dominantly clayey soils developed on stratified lacustrine deposits.
7	La Salle Soils	Variable textured soils developed on recent alluvial deposits.

Figure 8: Generalized Soils Map.

Table 2a. Key to the Soils of Ecoclimatic Subregion Gt_4 in the Rural Municipality of South Norfolk According to Drainage, Subgroup and Parent Material.

		Dominantly Sands and Gravels			
Soil Drainage	Taxanomic Subgroup	Sandy	Sandy Skeletal	Coarse Loamy	Coarse L over Cla
Well to Moderately Well Drained	Orthic Regosol	Skelding (SKL)			
	Cumulic Regosol	Aronet (ARN)			
	Orthic Black		Agassiz (ASZ)	Hochfeld (HHF)	Hibsin (H
	Calcareous Black		Birkenhead (BKA)		
Imperfectly Drained	Gleyed Cumulic Regosol				
	Gleyed Rego Black	Almasippi (ASS)		Reinland (RLD)	Rosebank
	Gleyed Black	Willowcrest (WWC)		Kronstal (KOT)	Elm Cree
	Gleyed Regosol	Long Plain (LOP)			
Poorly Drained	Rego Humic Gleysol	Lelant (LLT)		Osterwick (OWK)	Layland (
	Terric Mesisol				
	Typic Mesisol				

* St. Claude and Squirrel Creek Series are distinguished by possessing a significant layer of cla

** Osborne Series also associated with the Red River Association

*** Elm Creek and Poplar Point Series are distinguished by lacking a prominent surface A-horizon

	Dominantly Lacustrine Loams and Clays					
my y	Loamy over Sandy	Loamy over Fine Loamy	Loamy over Clayey	Fine Loamy	Clayey (shale derived stratified)	Fine Loa over San
N)	Rosengart (RSG)	Reinfeld (RFD)	Denham (DNH)	Eigenhof (EGF)		
RBK)	Neuenberg (NBG) St. Claude* (SUE)	Gnadenthal (GDH)	Graysville (GYV), Squirrel Creek* (SQR)	Neuhorst (NUH)	Blumengart (BMG)	Newton S
(EEK)	Jasset (JST)		Rignold (RGD)	Rathwell (RWL)		
AY)		Blumenfeld (BNF)	Edkins (EDK)		Blumenort (BUM)	

to silt-sized secondary carbonates near the surface

Dominantly Lacustrine Loams and Clays					
oamy over andy	Loamy over Fine Loamy	Loamy over Clayey	Fine Loamy	Clayey (shale derived stratified)	Fine Loamy over Sandy
osengart (RSG)	Reinfeld (RFD)	Denham (DNH)	Eigenhof (EGF)		
euenberg (NBG) t. Claude* (SUE) asset (JST)	Gnadenthal (GDH)	Graysville (GYV), Squirrel Creek* (SQR) Rignold (RGD)	Neuhorst (NUH) Rathwell (RWL)	Blumengart (BMG)	Newton Siding (NWN)
	Blumenfeld (BNF)	Edkins (EDK)		Blumenort (BUM)	

sized secondary carbonates near the surface

		Dominantly Loamy Alluvium		Organics	Land Units
ayey over ndy	Clayey (stratified)	Loamy (stratified)	Coarse to Fine Loamy (shale derived)	Organic	Undifferentiated Unit
	Winkler (WIK)	La Salle (LSL), Elm River*** (EMV)			Shellmouth Complex (SEU)
gas (DGS)	Deadhorse (DHO) Plum Coulee (PME)	Gervais (GVS), Poplar Point***(PPR)	Chortitz (CTZ)		
	Osborne** (OBO)	Willowbend (WWB)	Loewen (LEW)	Perillo (PER) Xavier (XVI)	

Table 2b. Key to the Soils of Ecoclimatic Subregions LBs_2 and Gt_2 in the Rural Municipality of South No
According to Drainage, Subgroup and Parent Material.

		Dominantly Till			Dominantl
Soil Drainage	Taxonomic Subgroup	Loamy Calcareous Mixed Till	Loamy Non-calcareous Shale Till	Loamy Calcareous Till over Shale Bedrock	Fine Loamy ov Loamy Calcare or Shale Till
Well to Moderately Well Drained	Orthic Regosol				
	Cumulic Regosol				
	Orthic Black	Darlingford (DGF)			Knudson (KUD)
	Calcareous Black				
	Rego Black	Hebbot (HEB)			
	Orthic Dark Gray	Dezwood (DZW)	Fifere (FFR)	Oakley (OAY)	Altamont (ATN
	Orthic Dark Gray Luvisol	Pembina (PBI)	Nayler (NYO)		Kingsley (KIS
Imperfectly Drained	Gleyed Cumulic Regosol				
	Gleyed Rego Black	Ferris (FRS)			Joyale (JYL)
	Gleyed Black				
	Gleyed Dark Gray				Tellier (TLI)
Poorly Drained	Rego Humic Gleysol	Horose (HOS)			Guerra* (GRR) Narish* (NSH)
	Terric Mesisol				
	Typic Mesisol				

* Guerra Series associated with Black Chernozems

* Narish Series associated with Dark Gray Chernozems

olk

Till	Dominantly Fluvial Lacustrine Sands and Gravels							
s Mixed	Sandy Skeletal	Sandy over Sandy Skeletal	Loamy over Sandy Skeletal	Sandy	Sandy Eolian	Coarse Loamy	Loamy	Fi Lo
				Arizona (AIZ)	Shilox (SHX)			
	Dorset (DOT)	Wheatland (WHL)	Croyon (CYN)	Stockton (SCK)			Fairland (FND)	Ram
							Travers (TAV)	Rem
	Marringhurst (MRH)			Cactus (CCS)			Durnan (DRN)	
	Leary (LRY)		Vandel (VDL)	Dobbin (DOB)			Halstead (HAT)	Fi
			Trinton (TNT)					
					Onahan (ONH)			
	Mansfield (MFI)		Capell (CXT)	Hummerston (HMO)			Taggart (TGR)	Pr
	Dexter (DXT)		Druxman (DXM)	Lavenham (LVH)		Gateside (GTD)	Torcan (TOC)	Cha
			Vartel (VTL)			Bone (BNE)		Dan
	Fortina (FTN)		Carvey (CAV)	Sewell (SEE)	Mockry (MKY)	Poolex (POX)	Vordas (VOS)	Tad

Dominantly Fluvial Lacustrine Sands and Gravels								Domin
	Sandy over Sandy Skeletal	Loamy over Sandy Skeletal	Sandy	Sandy Eolian	Coarse Loamy	Loamy	Fine Loamy	F o
			Arizona (AIZ)	Shilox (SHX)				
DOT)	Wheatland (WHL)	Croyon (CYN)	Stockton (SCK)			Fairland (FND)	Ramada (RAM)	W
						Travers (TAV)	Rempel (RMP)	
urst (MRH)			Cactus (CCS)			Durnan (DRN)		
RY)		Vandel (VDL)	Dobbin (DOB)			Halstead (HAT)	Firdale (FIR)	
		Trinton (TNT)						
				Onahan (ONH)				
d (MFI)		Capell (CXT)	Hummerston (HMO)			Taggart (TGR)	Prodan (PDA)	C
DXT)		Druxman (DXM)	Lavenham (LVH)		Gateside (GTD)	Torcan (TOC)	Charman (CXV)	
		Vartel (VTL)			Bone (BNE)		Danlin (DLN)	
(FTN)		Carvey (CAV)	Sewell (SEE)	Mockry (MKY)	Poolex (POX)	Vordas (VOS)	Tadpole (TDP)	

tly Lacustrine Loams and Clays				Alluvial Loams and Clays			
ne Loamy er Sandy	Coarse Loamy over Sandy	Clayey	Clayey over Shale Bedrock	Coarse to Fine Loamy	Clayey	Organic	Undifferentiated Unit
lwood (WWD)	Glenboro (GBO)	Janick (JIK)					Eroded Slopes Complex (ERX)
okdale (CKD)	Grover (GRO) Petrel (PTR)		Bishop (BIP)	Levine (LEI)	Assiniboine (ASB)		
	Grayson (GVS)			Basker (BKA)	Kerran (KRN)	Perillo (PER) Xavier (XVI)	

TABLE 3

General Soils Legend-Key to the Soils of the Rural Municipality of South Norfolk Based on Ecoclimatic Regions, Parent Material,Soil Drainage, Taxanomic Subgroup and Series

A. Soils Developed in the Grassland transition Ecoclimatic Region Subregion 4.

1. Soils developed on deep, weakly to moderately calcareous sandy (FS,LFS) lacustrine deposits.

   a) Well Drained

   - Skelding (Orthic Regosol) SKL
   - Aronet (Cumulic Regosol) ARN

   b) Imperfectly Drained

   - Almasippi (Gleyed Rego Black) ASS
   - Willowcrest (Gleyed Black) WWC
   - Long Plain (Gleyed Regosol) LOP

   c) Poorly Drained

   - Lelant (Rego Humic Gleysol) LLT

2. Soils developed on deep, moderately to strongly calcareous, sandy skeletal (GrS,GrLS,CS) fluvial deposits.

   a) Well Drained

   - Agassiz (Orthic Black) ASZ
   - Birkenhead (Calcareous Black) BKA

3. Soils developed on deep, moderately calcareous, coarse loamy (LVFS,VFS,FSL) lacustrine deposits.

   a) Well Drained

   - Hochfeld (Orthic Black) HHF

   b) Imperfectly Drained

   - Reinland (Gleyed Rego Black) RLD
   - Kronstal (Gleyed Black) KOT

c) Poorly Drained

- Osterwick (Rego Humic Gleysol) OWK

4. Soils developed on shallow, moderately to strongly calcareous sandy (FS,LFS) to coarse loamy (VFS,LVFS,FSL), fluvial and lacustrine sediments over moderately calcareous, clayey (SiC,C) lacustrine deposits.

   a) Well Drained

   - Hibsin (Orthic Black) HIN

   b) Imperfectly Drained

   - Rosebank (Gleyed Rego Black) RBK
   - Elm Creek (Gleyed Black) EEK

   c) Poorly Drained

   - Layland (Rego Humic Gleysol) LAY

5. Soils developed on shallow, moderately to strongly calcareous, loamy (VFSL,L,SiL), fluvial and lacustrine deposits over moderately calcareous, sandy (FS,LFS,LS) deposits.

   a) Well Drained

   - Rosengart (Orthic Black) RSG

   b) Imperfectly Drained

   - Neuenberg (Gleyed Rego Black) HBG
   - St. Claude (Gleyed Rego Black) SUE
   - Jasset (Gleyed Black) JST

6. Soils developed on shallow, stratified, moderately to strongly calcareous, loamy (VFSL,L,SiL) lacustrine deposits over moderately calcareous, fine loamy (CL,SiCL), lacustrine deposits.

   a) Well Drained

   - Reinfeld (Orthic Black) RFD

   b) Imperfectly Drained

   - Gnadenthal (Gleyed Rego Black) GDH

   c) Poorly Drained

- Blumenfeld (Rego Humic Gleysol) BNF

7. Soils developed on shallow, moderately to strongly calcareous loamy (L,SiL,VFSL,CL,SiCL) fluvial and lacustrine deposits over moderately calcareous, clayey (SiC,C), lacustrine deposits.

   a) Well Drained

   - Denham (Orthic Black) DNH

   b) Imperfectly Drained

   - Graysville (Gleyed Rego Black) GYV
   - Squirrel Creek (Gleyed Rego Black) SQR
   - Rignold (Gleyed Black) RGD

   c) Poorly Drained

   - Edkins (Rego Humic Gleysol) EDK

8. Soils developed on deep, moderately to strongly calcareous, fine loamy (CL,SiCL,SCL), fluvial and lacustrine deposits.

   a) Well Drained

   - Eigenhof (Orthic Black) EGF

   b) Imperfectly Drained

   - Neuhorst (Gleyed Rego Black) NUH
   - Rathwell (Gleyed Black) RWL

9. Soils developed on moderately to strongly calcareous stratified, dominantly clayey (SiC,C,SC) shale derived fluvial and lacustrine deposits.

   a) Imperfectly Drained

   - Blumengart (Gleyed Cumulic Regosol) BMG

   b) Poorly Drained

   - Blumenart (Rego Humic Gleysol) BUM

10. Soils developed on moderately to strongly calcareous, shallow fine loamy (SCL,CL,SiCL), fluvial and lacustrine deposits over moderately calcareous, sandy (LFS,FS) deposits.

    a) Imperfectly Drained

• Newton Siding (Gleyed Rego Black)	NWN

11. Soils developed on moderately to strongly calcareous, shallow clayey (SiC,C), lacustrine deposits over moderately calcareous, sandy (LFS,FS) deposits.

a) Imperfectly Drained

• Dugas (Gleyed Rego Black)	DGS

12. Soils developed on moderately to strongly calcareous, stratified, dominantly clayey (C,SiC,SC), fluvial and lacustrine deposits.

a) Well Drained

• Winkler (Orthic Black)	WIK

b) Imperfectly Drained

• Deadhorse (Gleyed Rego Black)	DHO
• Plum Coulee (Gleyed Black)	PME

c) Poorly Drained

• Osborne (Rego Humic Gleysol)	OBO

13. Soils developed on moderately to strongly calcareous, stratified, dominantly loamy (VFSL,SiL,L,SiCL,CL), recent fluvial deposits on the Assiniboine River.

a) Well Drained

• La Salle (Cumulic Regosol)	LSL
• La Salle, sandy variant (Cumulic Regosol)	LSL1
• Elm River (Cumulic Regosol)	EMV
• Elm River, sandy variant (Cumulic Regosol)	EMV1

b) Imperfectly Drained

• Gervais (Gleyed Cumulic Regosol)	GVS
• Poplar Point (Gleyed Cumulic Regosol)	PPR

c) Poorly Drained

• Willowbend (Rego Humic Gleysol)	WWB

14. Soils developed on loamy (VFSL,SiL,L,SiCL,CL), stratified, shale derived, recent fluvial deposits.

    a) Imperfectly Drained

    - Chortitz (Gleyed Cumulic Regosol) CTZ

    b) Poorly Drained

    - Loewen (Rego Humic Gleysol) LEW

15. Soils developed on thin (40-160 cm), dominantly fen moderately decomposed peat over coarse loamy (L,SiL,VFSL) fluvial and lacustrine deposits.

    a) Very Poorly Drained

    - Perillo (Terric Mesisol) PER
    - Perillo, fine loamy substrate variant (Terric Mesisol) PER1

16. Soils developed on deep (>160 cm), dominantly fen, moderately decomposed peat.

    a) Very Poorly Drained

    - Xavier (Typic Mesisol) XVI

17. Miscellaneous, variable textured soils on steeply sloping stream channels and escarpments.

    a) Dominantly Well to Excessively Drained

    - Shellmouth Complex (dominantly Orthic Regosol) SEU

B. Soils developed in the Grassland transition, subregion 2 and Low-Boreal, subhumid subregion 2 Ecoclimatic Regions.

1. Soils developed on moderately to very strongly calcareous, deep, loamy (L,SCL,CL), till of shale, limestone and granitic origin.

    a) Well Drained

    - Darlingford (Orthic Black) DGF
    - Hebbot (Rego Black) HEB
    - Dezwood (Orthic Dark Gray) DZW
    - Pembina (Orthic Dark Gray Luvisol) PBI

    b) Imperfectly Drained

    - Ferris (Gleyed Rego Black) FRS

  c) Poorly Drained

    - Horose (Rego Humic Gleysol) HOS

2. Soils developed on weakly to nonclacareous, deep, loamy (L,SCL,SiCL,CL), shale derived till deposits.

  a) Well Drained

    - Fifere (Orthic Dark Gray) FFR
    - Nayler (Orthic Dark Gray Luvisol) NYO

3. Soils developed on a variable veneer (25-90 cm) of moderately to strongly calcareous, loam (L,CL,SiCL) mixed till over weakly to nonclacareous shale bedrock.

  a) Well Drained

    - Oakley (Orthic Dark Gray) OAY

4. Soils developed on shallow, weakly to moderately calcareous, fine loamy (CL,SiCL) lacustrine deposits over moderately to very strongly calcareous, mixed till.

  a) Well Drained

    - Knudson (Orthic Black) KUD
    - Altamont (Orthic Dark Gray) ATN
    - Kingsley (Orthic Dark Gray Luvisol) KIS

  b) Imperfectly Drained

    - Joyale (Gleyed Rego Black) JYL
    - Tellier (Gleyed Dark Gray) TLI

  c) Poorly Drained

    - Guerra (Rego Humic Gleysol), Black associate GRR
    - Narish (Rego Humic Gleysol), Dark Gray associate NSH

5. Soils developed on deep, moderately to strongly calcareous, stratified sandy and sandy skeletal (LS,S,CS,GrS,GRCS), fluvial outwash and beach deposits.

  a) Well Drained

• Dorset (Orthic Black)	DOT
• Marringhurst (Rego Black)	MRH
• Leary (Orthic Dark Gray)	LRY

b) Imperfectly Drained

• Mansfield (Gleyed Rego Black)	MFI
• Mansfield, shale gravel variant (Gleyed Rego Black)	MFI1
• Dexter (Gleyed Black)	DXT

c) Poorly Drained

• Fortina (Rego Humic Gleysol)	FTN

6. Soils developed on shallow, weakly to moderately calcareous, sandy (LFS,FS,LS) over moderately to strongly calcareous, stratified, sandy skeletal (GrLS,GrS) deposits.

a) Well Drained

• Wheatland (Orthic Black)	WHL

7. Soils developed on shallow, moderately to strongly calcareous, loamy (L,CL,SCL,SiCL) deposits over moderately to strongly calcareous, stratified sandy and sandy skeletal (S,GrS,CS,GrCS) deposits.

a) Well Drained

• Croyon (Orthic Black)	CYN
• Croyon, shale gravel variant (Orthic Black)	CYN1
• Vandal (Orthic Dark Gray)	VDL
• Vandal, shale gravel variant (Orthic Dark Gray)	VDL1
• Trinton (Orthic Dark Gray Luvisol)	TNT
• Trinton, shale gravel variant (Orthic Dark Gray Luvisol)	TNT1

b) Imperfectly Drained

• Capell (Gleyed Rego Black)	CXT
• Capell, shale gravel variant (Gleyed Rego Black)	CXT1
• Druxman (Gleyed Black)	DXM

• Vartel (Gleyed Dark Gray)	VTL
• Vartel, shale gravel variant (Gleyed Dark Gray)	VTL1
c) Poorly Drained	
• Carvey (Rego Humic Gleysol)	CAV
8. Soils developed on weakly to moderately calcareous, sandy (LFS,FS), fluvial and lacustrine deposits.	
a) Well Drained	
• Arizona (Orthic Regosol)	AIZ
• Stockton (Orthic Black)	SCK
• Cactus (Rego Black)	CCS
• Dobbin (Orthic Dark Gray)	DOB
b) Imperfectly Drained	
• Hummerston (Gleyed Rego Black)	HMO
• Lavenham (Gleyed Black)	LVH
c) Poorly Drained	
• Sewell (Rego Humic Gleysol)	SEE
9. Soils developed on weakly to noncalcareous sandy (LFS,FS) eolian deposits.	
a) Well Drained	
• Shilox (Orthic Regosol)	SHX
b) Imperfectly Drained	
• Onahan (Gleyed Cumulic Regosol)	ONH
c) Poorly Drained	
• Mockry (Rego Humic Gleysol)	MKY
10. Soils developed on moderately to strongly calcareous, deep, coarse loamy (VFS,LVFS,FSL) lacustrine deposits.	
a) Imperfectly Drained	
• Gateside (Gleyed Black)	GTD

- Bone (Gleyed Dark Gray) BNE

b) Poorly Drained

- Poolex (Rego Humic Gleysol) POX

11. Soils developed on deep, moderately to strongly calcareous, loamy (VFSL,L,SiL), fluvial and lacustrine deposits.

a) Well Drained

- Fairland (Orthic Black) FND
- Traverse (Calcareous Black) TAV
- Durnan (Rego Black) DRN
- Halstead (Orthic Dark Gray) HAT

b) Imperfectly Drained

- Taggart (Gleyed Rego Black) TGR
- Torcan (Gleyed Black) TOC

c) Poorly Drained

- Vordas (Rego Humic Gleysol) VDS

12. Soils developed on deep, moderately to strongly calcareous, fine loamy (SiCL,CL) fluvial and lacustrine deposits.

a) Well Drained

- Ramada (Orthic Black) RAM
- Rempel (Calcareous Black) RMP
- Firdale (Orthic Dark Gray) FIR

b) Imperfectly Drained

- Prodan (Gleyed Rego Black) PDA
- Charman (Gleyed Black) CXV
- Danlin (Gleyed Dark Gray) DLN

13. Soils developed on shallow, moderately to strongly calcareous, fine loamy (CL,SiCL) fluvial and lacustrine deposits over moderately calcareous, stratified sandy (LFS,FS) fluvial deposits.

a) Well Drained

- Wellwood (Orthic Black) WWD

b) Imperfectly Drained

- Crookdale (Gleyed Rego Black) CKD

14. Soils developed on shallow, moderately to strongly calcareous, coarse loamy (VFS,LVFS,FSL) fluvial and lacustrine deposits over moderately calcareous, stratified sandy (LFS,FS) fluvial deposits.

a) Well Drained

- Glenboro (Orthic Black) GBO

b) Imperfectly Drained

- Grover (Gleyed Rego Black) GRO
- Petrel (Gleyed Black) PTR

c) Poorly Drained

- Grayson (Rego Humic Gleysol) GYS

15. Soils developed on deep, moderately to strongly calcareous, clayey (SiC,C) lacustrine deposits.

a) Well Drained

- Janick (Orthic Black) JIK

16. Soils developed on shallow, weakly to noncalcareous, clayey (SiC,C) deposits of weathered shale over weakly to noncalcareous shale bedrock.

a) Imperfectly Drained

- Bishop (Gleyed Black) BIP

17. Soils developed on moderately to strongly calcareous, stratified, coarse to fine loamy (FSL,VFS,L,SiL,CL,SiCL) recent fluvial deposits.

a) Imperfectly Drained

- Levine (Gleyed Cumulic Regosol) LEI

b) Poorly Drained

- Basker (Rego Humic Gleysol) BKA

18. Soils developed on moderately to strongly calcareous, stratified, clayey (SiC,C) recent fluvial deposits.

    a) Imperfectly Drained

    - Assiniboine (Gleyed Cumulic Regosol) ASB

    b) Poorly Drained

    - Kerran (Rego Humic Gleysol) KRN

19. Miscellaneous, variable textured, eroded soils on steeply sloping stream channels and escarpments.

    a) Well Drained

    - Eroded Slopes Complex (dominantly Orthic Regosol) ERX

Almasippi Series (ASS)

The Almasippi series consists of imperfectly drained Gleyed Rego Black soil developed on moderately calcareous, uniform, sandy (LFS,FS) lacustrine sediments over a lacustrine clay substrate usually within 3 meters of the surface which impedes downward water movement. These soils occur in middle to lower slope positions of level to very gentle slopes on undulating landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Almasippi soils are moderately eroded, non-stony, and occasionally saline. They have low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes trembling aspen, bur oak and tall prairie grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Almasippi soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Apk horizon, 15 to 20 cm thick, a light brownish gray AC horizon, 10 to 15 cm thick and a yellowish brown Ck horizon, with prominent mottles. A typical profile also contains a light coloured Ca horizon below the AC horizon.

Almasippi soils occur in close association with Skelding Longplain and Lelant soils. They are similar to Willowcrest soils by having a Gleyed Black profile developed in sands but differ from them in having no Bm horizon. Almasippi soils were previously mapped as Black Meadow associates of the Almasippi in the Carberry (1957) soil report.

Arizona Series (AIZ)

The Arizona series consists of moderately well to well drained Orthic Regosol soil developed on weakly to moderately calcareous, sandy (FS, LFS,LS), lacustrine and deltaic deposits. These soils occur in upper slope and knoll positions of gentle slopes on hummocky landscapes and have rapid permeability, moderate surface runoff, and a low water table during the growing season. Arizona soils are severely wind eroded, non-stony, and non-saline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes scrub oak, black spruce and prairie grasses. The majority of these soils are currently wooded or used for natural grassing.

In a representative profile of Arizona soil there is no solum. The profile is characterized by a gray to light gray Ah horizon, 5 to 15 cm thick, and a brown to very pale brown Ck horizon, with faint reddish brown mottles.

Arizona soils occur in close association with Cactus and Stockton soils They are similar to Shilox soils by having a Regosolic profile in sand deposits but differ from them in having deposits of lacustrine origin while Shilox soils are eolian in origin. Arizona soils were previously mapped as eroded phases of the Stockton Association in the Carberry (1957) soil report.

Altamont Series (ATN)

The Altamont series consists of well to moderately well drained Orthic Dark Gray soil developed on a mantle (25 to 100 cm) of weakly to moderately calcareous, uniform, fine loamy (L, CL, SiCL), lacustrine sediments over moderately to strongly calcareous, deep, uniform fine loamy (L, SiL, CL) mixed till deposits. These soils occur in middle to upper slope positions of very gentle slopes on undulating landscapes and have moderate permeability moderate surface runoff and a low water table during the growing season. Altamont soils are non-eroded, non-stony and non-saline. They have high available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen-oak groves. The majority of these soils are currently used for grain crop production.

In a representative profile of Altamont soil the solum is approximately 60 cm thick. The profile is characterized by a dark gray Ap or Ah horizon, 5 to 15 cm thick, a dark gray Ahe or AB horizon, 10 to 30 cm thick with rinsed ped surfaces, a brown to pale brown BM horizon, 10 to 25 cm thick a transition pale brown II BC horizon 10 to 20 cm thick and occasionally a white IICca horizon 4 to 6 cm thick. The parent material is typically pale brown to very pale brown strongly calcareous mixed till.

Altamont soils occur in close association with Kingsley, Knudson and Tellier soils. They are similar to Firdale soils by having Orthic Dark Gray profile development in fine loamy lacustrine deposits but differ from Firdale soils because of the substrate of calcareous regional till not present in Firdale soils. Altamont soils were previously mapped as the dominant associate of the Altamont Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Agassiz Series (ASZ)

The Agassiz series consists of well to excessively drained Orthic Black soil developed on strongly calcareous, stratified, sandy skeletal (S,GrS,GrLS) beach deposits. These soils occur in upper and middle positions of gentle to moderate slopes on ridged landscapes and have rapid permeability, rapid surface runoff, and a low water table during the growing season. Agassiz soils are slightly eroded, slightly stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes prairie grasses, shrubs and bur oak. The majority of these soils are currently excavated for road construction.

In a representative profile of Agassiz soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ah horizon, 7 to 15 cm thick, with single grain to weak granular structure, a brownish gray Bm horizon, 15 to 25 cm thick which is weakly developed, and a very pale brown Ck horizon, with stratified sand and gravel. Agassiz soils are similar to Leary soils by having a well drained profile in beach sands but differ from them in having a more weakly developed profile. Agassiz soils were previously mapped as Blackearth associates of the Agassiz Association in the Carberry (1957) soil report.

Assiniboine Series (ASB)

The Assiniboine series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on moderately to strongly calcareous, stratified, clayey (SiC,C) deposits. These soils occur in lower slope positions of very gentle slopes on flood plain landscapes and have moderately slow permeability, slow surface runoff, and a medium water table during the growing season. Assiniboine soils are slightly water eroded, non-stony, and non-saline. They have high available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes ash, elm, tall prairie and meadow grasses. The majority of these soils are currently cultivated.

In a representative profile of Assiniboine soil there is no solum. The profile is characterized by a dark gray to gray Ah horizon, 5 to 20 cm thick, and a dark gray Ck horizon, with many prominent mottles. The parent material is typically stratified and may contain dark strata representing former surfaces.

Assiniboine soils occur in close association with poorly drained Kerran soils. They are similar to Levine soils by having a Gleyed Cumulic Regosol profile but differ from them in having finer textured deposits. Assiniboine soils were previously mapped as inclusions of the Assiniboine Complex in the Carberry (1957) soil report.

Aronet Series (ARN)

The Aronet series consists of moderately well drained Cumulic Regosol soil developed on weakly to moderately calcareous, sandy (FS,LS,LFS), eolian deposits. Aronet soils are found along fence rows, adjacent to woodlots and in similar areas where wind blown sand can accumulate. These soils occur in upper slope positions of gentle to moderate slopes on ridged landscapes and have rapid permeability, moderate surface runoff, and a slow water table during the growing season. Aronet soils are highly eroded, non-stony, and non-saline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes tall prairie grasses. The majority of these soils are currently in native vegetation.

In a representative profile of Aronet soil has no soil solum. The profile is characterized by a light brown Ap horizon, 5 to 20 cm thick, with single grain structure. The profile is also characterized by a number of alternating dark brown and light brown layers. The darker layers are mostly buried Ah horizons. The overblown layers usually overlie a Chernozem like profile at depth. The parent material is typically mottled at depths of 75 cm or more.

Aronet soils occur in close association with Skelding, Longplain and Willowcrest soils. They are similar to Skelding soils by having no soil development but differ from them in having buried Ah horizons. Aronet soils were previously mapped as eroded inclusion of the Almasippi Association in the Carberry (1957) soil report.

Birkenhead Series (BKA)

The Birkenhead series consists of well drained Calcareous Black soil developed on moderately to strongly calcareous, stratified sandy (S,CS) and sandy skeletal (GrS,GrCS) beach deposits. These soils occur in upper positions of gentle slopes on northwest-southeast trending ridge landscapes and have rapid permeability, moderate to slow surface runoff, and a low water table during the growing season. Birkenhead soils are slightly eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes tall prairie grasses. The majority of these soils are currently seeded to domestic grasses and legumes.

In a representative profile of Birkenhead soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 30 cm thick, a weakly calcareous, brown Bm horizon, 10 to 20 cm thick with stratified sands and gravels, and a pale brown, strongly calcareous Ck horizon.

Birkenhead soils occur in close association with Agassiz soils. They are similar to Agassiz soils by having sandy skeletal material and a black surface but differ from them in having a carbonated Bm horizon. Birkenhead soils were previously mapped as minor inclusions of the Agassiz Association in the Carberry (1957) soil report.

Basker Series (BKR)

The Basker series consists of poorly to very poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, stratified, loamy (FSL,VFSL,L,SiL,SiCL), recent alluvial deposits. These soils occur in depression positions of nearly level slopes on flood plain landscapes and have slow permeability, very slow surface runoff, and a high water table during the growing season. Basker soils are slightly water eroded, non-stony, and occasionally slightly saline. They have a high available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes and willows. The majority of these soils are currently in native vegetation because they are subject to flooding and saturated conditions in the spring.

In a representative profile of Basker soil there is no soil solum. The profile is characterized by light grayish brown Ahk horizon, 5 to 20 cm thick, with iron stains, and a stratified, olive brown Ckg horizon, with prominent iron mottles in the sandy strata. A typical profile also contains thin organic layers indicating former surfaces.

Basker soils occur in close association with Levine soils. They are similar to Kerran soils by having a poorly drained profile developed in recent alluvium but differ from them in having mostly loam rather than clay textures. Basker soils were previously mapped as Meadow associates of the Assiniboine Complex in the South-Central (1943) and Carberry (1957) reports.

Bishop Series (BIP)

The Bishop series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 100 cm) of moderately calcareous, shallow, uniform, clayey (SiC,C) deposits containing shale fragments over non- to weakly calcareous weathered, Odanah, siliceous, shale bedrock. These soils occur in middle to lower positions of moderate slopes on the Manitoba Escarpment where soil parent material is derived from bedrock. They have slow to very slow permeability, moderate surface runoff, and a high water table during the growing season. Bishop soils are moderately water eroded, non-stony, and frequently slightly saline. They also have a high available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes shrubs, willows, ash and oak. The majority of these soils are currently in native vegetation.

In a representative profile of Bishop soil the solum is approximately 30 cm thick. The profile is characterized by a dark gray to very dark gray Ah horizon, 25 to 35 cm thick, usually with carbonates and salts, a transitional AC horizon, 30 to 40 cm thick with carbonates, mottles and gypsum crystals, and shale bedrock at a depth of 75 to 90 cm. A typical profile also is influenced by seepage from upper slopes resulting in carbonated and saline profiles.

Blumenfeld Series (BNF)

The Blumenfeld series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, loamy (VFSL,L,SiL,SiCL, CL), fluvial and lacustrine deposits. These soils occur in level to depressional positions of level slopes on level landscapes and have moderately slow permeability, very slow surface runoff, and ponding or a high water table during the growing season. Blumenfeld soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, seeds, rushes and meadow grasses. The majority of these soils are currently in native vegetation.

In a representative profile of Blumenfeld soil the solum is approximately 40 cm thick. The profile is characterized by a carbonated, very dark gray Ah horizon, 25 to 40 cm thick, a thin, dark grayish brown AC horizon, 10 to 15 cm thick with prominent mottles, and a light gray Ck horizon with prominent iron mottles. A typical profile also contains a Cca horizon of lime accumulation.

Blumenfeld soils occur in close association with Gnadenthal and Reinfeld soils. They are similar to Edkins soils by having a poorly drained profile in loamy deposits but differ from them in having loamy substrate while Edkins soils are clayey at depth. Blumenfeld soils were previously mapped as meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Blumengart Series (BMG)

The Blumengart series consists of imperfectly drained Gleyed Regosol soil developed on weakly to moderately calcareous, clayey (SiC,C), recent fluvial deposits. Blumengart soils have been prone to flooding, but improved drainage has decreased the flooding hazard in recent years. These soils occur in level to depressional positions of level slopes on flood plain landscapes and have slow to very slow permeability, slow surface runoff, and a high water table during the growing season. Blumengart soils are non-eroded, non-stony, and frequently slightly saline. They have a high available water holding capacity, low organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, willows and shrubs. The majority of these soils are currently cultivated.

In a representative profile of Blumengart soil there is no solum. The profile is characterized by a dark gray Ah horizon, 10 to 18 cm thick, and a gray to dark gray Ck horizon, with prominent iron mottles. A typical profile also contains thin strata of lighter textured former Ah horizons in the subsoil.

Blumengart soils occur in close association with Blumenort soils. They are similar to Assiniboine soils by having an imperfectly drained Regosol profile but differ from them in occurring below the Escarpment in a warmer and more moist climatic area. Blumengart soils were previously mapped as immature associates of the Gretna Association in the South-Central (1943) soil report.

Blumenort Series (BUM)

The Blumenort series consists of poorly drained Rego Humic Gleysol soil developed on moderately calcareous, deep, stratified, clayey (SiC,C), recent alluvial deposits in flood prone areas along stream channels at the base of the Manitoba Escarpment. These soils occur in depressional positions of nearly level slopes on level landscapes and have very slow permeability, slow surface runoff, and a high water table during the growing season. Blumenort soils are non-eroded, non-stony, and frequently moderately saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently drained to reduce the hazard of flooding and used for cereal crop production.

In a representative profile of Blumenort soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray, calcareous Ah horizon, 10 to 18 cm thick, with slight salinity, a thin transitional AC horizon, 5 to 10 cm thick, and a dark olive gray Ck horizon, with numerous fine distinct mottles. A typical profile also contains light gray gypsum crystals in the C horizon.

Blumenort soils occur in close association with Blumengart soils. They are similar to Kerran soils by having a poorly drained profile in clayey alluvium but differ from them in occurring below the Manitoba Escarpment in a warmer and more moist climate. Blumenort soils were previously mapped as Meadow associates of the Gretna Association in the South-Central (1943) soil report.

Bone Series (BNE)

The Bone series consists of imperfectly drained Gleyed Dark Gray soil developed on weakly calcareous, deep, stratified, coarse loamy and coarse silty (VFS,LVFS,FSL) lacustrine deposits. These soils occur in middle positions of very gentle to gentle slopes on hummocky landscapes and have slow permeability, slow surface runoff, and a medium water table during the growing season. Bone soils are slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain production.

In a representative profile of Bone soil the solum is approximately 90 cm thick. The profile is characterized by a dark gray to very dark gray Ah horizon, 20 to 30 cm thick, a grayish brown to brown Bmg or Bmgj horizon, 40 to 55 cm thick, a dark grayish brown Btjg or Btgj horizon, 5 to 10 cm thick, a transitional BC horizon, 5 to 10 cm thick, and a light gray, silty textured Ck horizon. A typical profile also contains layers of LVFS to SiL within a meter of the surface.

Bone soils occur in close association with Halstead, Gateside and Poolex soils. They are similar to Danlin soils by having a Gleyed Dark Gray profile but differ from them in having dominantly coarser textured sediments. Bone soils were previously mapped as loamy Degraded Black associates of the Firdale Association in the Carberry (1957) soil report.

Cactus Series (CCS)

The Cactus series consists of well drained Rego Black soil developed on moderately calcareous, deep, stratified, sandy (FS,LFS,LS), lacustrine and deltaic deposits. These soils occur in upper slope and crest positions of gentle slopes on undulating duned landscapes and have moderately rapid to rapid permeability, moderate to moderately rapid surface runoff, and a low water table during the growing season. Cactus soils are highly prone to wind erosion, and are non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, bur oak and tall prairie grasses. The majority of these soils are currently used for natural grasing

In a representative profile of Cactus soil the solum is approximately 15 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 16 cm thick, a dark gray AC horizon, 4 to 8 cm thick which is calcareous, a thin Cca horizon, 5 to 10 cm thick with lime accumulation and a light gray to pale brown Ck horizon.

Cactus soils occur in close association with Stockton, Arizona and Sewell soils. They are similar to Stockton soils by having a well drained profile developed in sandy deposits but differ from them in having no Bm horizon. Cactus soils were previously mapped as minor Blackearth associates of the Stockton Association in the Carberry (1957) soil report.

Charman Series (CXV)

The Charman series consists of imperfectly drained Gleyed Black soil developed on strongly to very strongly calcareous, fine loamy (CL,SiCL), lacustrine deposits. In areas of seepage or discharge, soluble salts in the subsoil can be translocated near the surface in sufficient quantities to affect crop growth. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate permeability, slow surface runoff, and a medium high water table during the growing season. Charman soils are non-eroded, non-stony, and frequently slightly saline. They have a moderately high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, willows, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Charman soil the solum is approximately 40 cm thick. The profile is characterized by very dark gray to black Ah horizon, 15 to 25 cm thick, a dark grayish brown Bmgj horizon, 12 to 30 cm thick, a transitional BC horizon, 5 to 8 cm thick and a pale brown, silty textured Ckgj horizon, with iron mottles and frequently gypsum crystals.

Charman soils occur in close association with Ramada, Carroll and Tadpole soils. They are similar to Prodan soils by having an imperfectly drained profile and fine loamy deposits but differ from them in having a Bmgj horizon. Charman soils were previously mapped as Black-Meadow associates of the Holland Association in the Carberry (1957) soil report.

Capell Series (CXT)

The Capell series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, loamy (SiL, L, CL), lacustrine sediments over moderately to strongly calcareous, deep stratified, sandy to sandy-skeletal (GrS, GrLS), glaciofluvial deposits. These soils occur in lower slope positions of gentle to moderate slopes on hummocky landscapes and have moderate to rapid permeability, moderate surface runoff and a medium water table during the growing season. Capell soils are occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Capell soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to black Apk or Ahk horizon, 15 to 25 cm thick, a dark gray to gray, calcareous AC horizon, 5 to 15 cm thick, a light gray IICca horizon, 5 to 10 cm thick with secondary carbonate accumulation and a light yellowish brown IICk horizon with common, distinct iron mottles.

Capell soils occur in close association with Croyon and Carvey soils. They are similar to Druxman soils by having the same sequence of parent materials and the same natural drainage but differ from Druxman soils because of a more weakly developed profile than that typical of Druxman soils. Capell soils were previously mapped as an imperfectly drained associate of the Agassiz Association in the reconnaissance soil survey of South- Central Manitoba (1943).

Capell Shaly Variant Series (CXT-1)

The Capell Shaly Variant series is characterized by a Gleyed Rego Black (carbonated) solum on an imperfectly drained thin mantle (25 to 90 cm) of moderately to strongly calcareous loamy (L,CL,SiCL,SCL) sediments overlying moderately to strongly calcareous sand and gravel deposits intermixed with varying amounts of shaly fragments.

These soils occur on level to very gently sloping topography or on the lower slope positions of undulating topography. These soils have moderately slow permeability in the upper sediments and rapid permeability in the lower coarser sediments, or restricted permeability during periods of subsoil saturation due to a perched condition or high water level. In some areas, where the water contains appreciable soluble salts, a sufficient concentration of salts may occur to inhibit or retard the growth of grasses or cereals.

The solum has a very dark gray to black Ahk horizon, 15 to 24 cm thick, a dark gray to gray AC horizon, 5 to 15 cm thick. A lime accumulation horizon, 8 to 12 cm thick extends to or into the coarser materials. Brownish yellow mottles are common in the coarser sediments below.

Carvey Series (CAV)

The Carvey series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, loamy (SiL, L, SL) lacustrine sediments over moderately to strongly calcareous, sandy to sandy skeletal glaciofluvial deposits. These soils occur in depressional positions of nearly level slopes on level landscapes and have moderate permeability slow surface runoff and a high water table during the growing season. Carvey soils are occasionally slightly saline. They have medium over low available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation often includes sedges and meadow grasses. The majority of these soils are currently used for natural grazing.

In a representative profile of Carvey soil the solum is approximately 20 cm thick. The profile is characterized by a thin (2 to 5 cm) moderately decomposed LFH horizon a very dark gray, calcareous Ah horizon, 7 to 15 cm thick and a dark gray, calcareous, transition AC horizon, 10 to 20 cm thick, and a pale brown, calcareous IICk horizon with yellowish brown mottles. A typical profile also contains manganese concretions in the subsoil and shells at the surface.

Carvey soils occur in close association with Capell, Druxman and Croyon soils. They are similar to Tadpole soils by having a Rego Humic Gleysol profile developed in loamy lacustrine deposits, but differ from Tadpole soils by having a sandy to sandy-skeletal substrate within a meter of the mineral surface. Carvey soils were previously mapped as a Meadow associate with a loamy veneer of the Agassiz Association in the Carberry (1957) soil report.

Carvey Shaly Variant Series (CAV-1)

The Carvey Shaly Variant series is characterized by a Rego Humic Gleysol (carbonated) solum on poorly drained thin mantle (25 to 90 cm) of moderately to strongly calcareous loamy (L,CL,SiCL,SCL) overlying moderately to strongly calcareous sand and gravel deposits intermixed with varying amounts of shaly fragments.

They occur in level to depressional sites which have a water table at or near the surface for part of the year. Runoff is negligible; permeability of the loamy sediments is moderately slow above the saturation zone. In areas where the seepage water contains soluble salts, a sufficient concentration of salts may occur in the soil to inhibit the growth of the normal sedge and meadow grasses.

The solum has a moderately decomposed organic layer, 2 to 5 cm thick, a very dark gray carbonated Ahk horizon, 7 to 15 cm thick, and a thin dark gray transitional AC horizon. A lime accumulation layer (Cca) is commonly present. Yellowish brown mottles are common in the transitional AC, the Cca horizon and the subsoil.

Chortitz Series (CTZ)

The Chortitz series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on moderately calcareous, deep, stratified, loamy (L,L,CL,SiCL), recent alluvial deposits. Lighter strata of fine sand to sandy loam or heavier strata of silty clay to clay can also occur. These soils occur in middle positions of very gentle slopes on flood plain landscapes and have moderately slow permeability, slow surface runoff, and a high water table during the growing season. Chortitz soils are flood-prone non-stony, and occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes willows, shrubs, tall prairie and meadow grasses. The majority of these soils are currently in natural vegetation.

In a representative profile of Chortitz soil is weakly developed. The profile is characterized by a dark gray, calcareous Ap horizon, 10 to 18 cm thick, with granular structure, and a dark grayish brown to pale brown Ck horizon that is moderately calcareous and mildly saline. A typical profile also contains numerous fine mottles and gypsum crystals.

Chortitz soils occur in close association with Loewen soils. They are similar to Levine soils by having a Gleyed Cumulic Regosol profile developed in recent alluvium but differ from them in occurring in a warmer and more moist climate below the Manitoba Escarpment. Chortitz soils were previously mapped as associates of the Assiniboine Complex in the Carberry (1957) soil report.

Crookdale Series (CKD)

The Crookdale series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (25 to 100 cm) of strongly calcareous, stratified, fine loamy (CL, SiCL) lacustrine sediments over strongly calcareous, deep uniform sandy (LFS, FS, S) fluvial lacustrine deposits. These soils occur in lower slope positions of level to nearly level slopes on level landscapes and have moderate permeability moderately slow surface runoff and a medium water table during the growing season. Crookdale soils are non-eroded, non-stony and slightly saline. They have high available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Crookdale soil the solum is approximately 25 cm thick. The profile is characterized by a black Ah to Ap horizon, 10 to 25 cm thick, a dark grayish brown transitional AC horizon, 10 to 20 cm thick with faint iron mottles, a white Cca horizon, 5 to 10 cm thick of lime accumulation and a light olive brown IICk horizon with prominent iron mottles.

Crookdale soils occur in close association with Wellwood soils. They are similar to Prodan soils by having a Gleyed Rego Black profile developed in fine loamy lacustrine deposits but differ from Prodan soils which develop in deep fine loamy deposits by grading to sandy deposits at depth. Crookdale soils were previously mapped as an associate of the Glenboro association in the reconnaissance soil survey of South-Central Manitoba (1943).

Croyon Series (CYN)

The Croyon series consists of moderately well to well drained Orthic Black soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, loamy (L, SiL, CL) lacustrine sediments over moderately to strongly calcareous, stratified, deep sandy-skeletal (GrS, GrLS), glacio-fluvial deposits. These soils occur in middle and upper slope positions of very gentle slopes on undulating landscapes and have medium over rapid permeability moderately rapid surface runoff and a low water table during the growing season. Croyon soils have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen-oak groves. The majority of these soils are currently used for grain crop production.

In a representative profile of Croyon soil the solum is approximately 35 cm thick. The profile is characterized by a very dark gray Ah or

Ap horizon, 10 to 15 cm thick, a dark brown Bm horizon, 10 to 25 cm thick, a yellowish brown IICca horizon, 10 to 20 cm thick with secondary carbonate accumulation and a light yellowish brown IICk horizon. The parent material is typically stratified with thin (<5 cm) layers of SiL, CS, GrS and SL textures.

Croyon soils occur in close association with Zarnet, Capell and Druxman soils. They are similar to Vandal soils by having a coarse-loamy mantle over sandy-skeletal deposits at depth but differ from the Orthic Dark Gray Vandal soils in having a less strongly developed Orthic Black soil profile. Croyon soils were previously mapped as loamy surface associates of the Agassiz association in the reconnaissance soil survey of South-Central Manitoba (1943).

Croyon Series, shale gravel substrate variant (CYN1)

The Croyon series shale gravel variant, occurs in close association with typical Croyon soils and differs in having dominantly shale derived coarse fragments in the sandy-skeletal substrate.

Croyon Series, sandy sybstrate variant (CYN2)

The Croyon series sandy substrate variant, occurs in close association with typical Croyon soils and differs in having dominantly sandy substrate rather than sandy-skeletal substrate deposits.

Danlin Series (DLN)

The Danlin series consists of imperfectly drained Gleyed Dark Gray soil developed on moderately to strongly calcareous, fine loamy (CL,SiCL,SCL,L,SiL), lacustrine deposits. These soils occur in lower slope positions of very gentle to gentle slopes on rolling to undulating landscapes and have moderate permeability, moderate to moderately slow surface runoff, and a medium water table during the growing season. Danlin soils are non-eroded, nonstony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Danlin soil the solum is approximately 80 cm thick. The profile is characterized by a dark gray Ap horizon, 10 to 15 cm thick, a transitional AB horizon, 8 to 12 cm thick a very dark grayish brown to grayish brown Btjg horizon, 15 to 25 cm thick with faint mottles and a grayish brown Ck horizon, with numerous faint mottles.

Danlin soils occur in close association with Firdale and Tadpole soils. They are similar to Bone soils by having a Gleyed Dark Gray profile in lacustrine deposits but differ from them in having dominantly fine loamy rather than coarse loamy sediments. Danlin soils were previously mapped as Degrading Black Meadow associates of the Firdale Association in the Carberry (1957) soil report.

Deadhorse Series (DHO)

The Deadhorse series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, deep, stratified, clayey (SiC,C), fluvial and lacustrine deposits. Thin strata of very fine sand to clay loam often occur within 1-2 meters of the surface. These soils occur in middle positions of level to very gentle slopes on undulating landscpaes and have very slow permeability, slow surface runoff, and a high water table during the growing season. Deadhorse soils are non-eroded, non-stony, and frequently slightly saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, aspen and oak. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Deadhorse soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 25 cm thick, a carbonated, dark gray to gray AC horizon, 8 to 20 cm thick and a Ck horizon with faint mottles.

Deadhorse soils occur in close association with Winkler and Plum Coulee soils. They are similar to Plum Coulee soils by having an imperfectly drained, clayey profile but differ from them in having no Bm horizon. Deadhorse soils were previously mapped as clayey Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Darlingford Series (DGF)

The Darlingford series consists of well drained Orthic Black soil developed on moderately to strongly calcareous, deep, uniform, loamy (L,CL,SiCL), nearly stone-free mixed till deposits. These soils occur in middle to upper positions of very gentle to gentle slopes on undulating to rolling landscapes and have medium to moderately slow permeability moderate surface runoff and a medium water table during the growing season. Darlingford soils are slightly eroded and slightly stony. They have moderate available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen poplar stands. The majority of these soils are currently used for grain crop production.

In a representative profile of Darlingford soil the solum is approximately 60 cm thick. The profile is characterized by a very dark gray Ap or Ah horizon, 15 to 20 cm thick, a black Ah horizon, 5 to 10 cm thick, a brown to dark brown Bm or Btj horizon, 20 to 30 cm thick and a pale brown Cca horizon 10 to 15 cm thick. The parent material is typically yellowish brown mixed till with few coarse fragments.

Darlingford soils occur in close association with Dezwood, Nikkel and Cazlake soils. They are similar to Nikkel soils by having a dark surface layer and well developed B horizon but differ from Nikkel soils by being well drained while Nikkel soils are imperfectly drained. Darlingford soils were previously mapped as the dominant associate of the Darlingford association in the reconnaissance soil survey of South- Central Manitoba (1943).

Denham Series (DNH)

The Denham series consists of moderately well to well drained Orthic Black soil developed on a mantle (60 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), lacustrine sediments over moderately to strongly calcareous, deep, clayey (SiÇ,C,SC), lacustrine deposits. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderately permeable loams over slowly permeable clays, moderate to moderately rapid surface runoff, and a low water table during the growing season. Denham soils are non-eroded, non-stony, and non-saline. They have medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Denham soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray to black Ap horizon, 20 to 30 cm thick, a very dark grayish brown to brown Bm horizon, 25 to 35 cm thick, a weakly calcareous BC horizon, 5 to 10 cm thick, and a yellowish brown to pale brown, moderately to strongly calcareous C horizon. The parent material is typically faintly mottled at depth.

Denham soils occur in close association with Rignold, Graysville and Edkins soils. They are similar to Hibsin soils by having an Orthic Black profile and clayey substrate but differ from them in having a loamy mantle rather than a coarse loamy mantle. Denham soils were previously mapped as Blackearth associates of the Rathwell Association in the Carberry (1957) soil report.

Dexter Series (DXT)

The Dexter series consists of imperfectly drained Gleyed Black soil developed on moderately to strongly calcareous, deep, stratified, sandy skeletal (FS,CS,GrS), glaciofluvial deposits. These soils occur in middle positions of very gentle to gentle slopes on undulating landscapes and have rapid permeability, moderate surface runoff, and a medium water table during the growing season. Dexter soils are slightly eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes bur oak, aspen, shrubs and prairie grasses. The majority of these soils are currently used for forage crops and grazing.

In a representative profile of Dexter soil the solum is approximately 40 cm thick. The profile is characterized by very dark gray Ah horizon, 15 to 20 cm thick, a grayish brown to brown Bm horizon, 10 to 25 cm thick, a Cca horizon, 5 to 8 cm thick with lime accumulation and a mottled and calcareous Ck horizon. A typical profile also varies in depth depending on the depth of finer textured surface layers.

Dexter soils occur in close association with Dorset Marringhurst and Fortina soils. They are similar to Mansfield soils by having an imperfectly drained profile developed in sandy skeletal deposits, but differ in having a Bm horizon. Dexter soils were previously mapped as Black Meadow associates of the Agassiz in the Carberry (1957) soil report.

Dezwood Series (DZW)

The Dezwood series consists of moderately well to well drained soil developed on moderately to strongly calcareous, deep, uniform, loamy (L, CL, SiCL) mixed shale, limestone and granite till deposits. These soils occur in middle and upper positions of gentle to moderate slopes on hummocky landscapes and have medium to moderately slow permeability moderate to rapid surface runoff and a medium water table during the growing season. Dezwood soils are slightly eroded and slightly stony. They have medium available water holding capacity, medium organic matter content, and medium to high natural fertility. Native vegetation often includes tall prairie grasses interspersed with aspen-popular groves. The majority of these soils are currently used for grain crop production.

In a representative profile of Dezwood soil the solum is approximately 40 cm thick. The profile is characterized by a dark grayish brown Ah or Ap horizon, 15 to 20 cm thick, occasionally a thin light gray Ae horizon, 2 to 4 cm thick, a pale brown Bt horizon, 20 to 40 cm thick, and a light gray Cca horizon 15 to 30 cm thick. The parent material is typically light gray mixed till with few coarse fragments.

Dezwood soils occur in close association with Ferris, Zaplin and Nikkel soils. They are similar to Pembina soils by having been developed in a calcareous mixed regional till but differ from them by having a luvisolic Ae horizon greater than 5 cm thick occurring in undisturbed profiles. Dezwood soils were previously mapped as gray black associates of the Pembina Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Dorset Series (DOT)

The Dorset series consists of moderately well to well drained Orthic Black soil developed on moderately to strongly calcareous, deep, stratified, sandy to sandy skeletal (S,GrS,GrCS), outwash and glaciofluvial deposits. These soils occur in upper positions of gentle slopes on hummocky landscapes and have very rapid permeability, moderate to moderately rapid surface runoff, and a low water table during the growing season. Dorset soils are non-eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen-oak stands and tall prairie grasses. The majority of these soils are currently used for grazing or excavated for gravel deposits.

In a representative profile of Dorset soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 12 to 18 cm thick, a dark brown Bm horizon, 15 to 22 cm thick, a Cca horizon, 6 to 12 cm thick with lime accumulation and a light brown Ck horizon, with stratified sands and gravels.

Dorset soils occur in close association with Mansfield, Dexter and Fortina soils. They are similar to Marringhurst soils by having a well drained profile in glaciofluvial deposits but differ from them in having a Bm horizon. Dorset soils were previously mapped as Blackearth associates of the Marringhurst Association in the Carberry (1957) soil report.

Dobbin Series (DOB)

The Dobbin series consists of well drained Orthic Dark Gray soil developed on weakly to non-calcareous, deep, sandy (LFS,FS,S), lacustrine and eolian deposits. These soils occur in middle and upper positions of gentle slopes on undulating to hummocky landscapes and have rapid permeability, rapid surface runoff, and a low water table during the growing season. Dobbin soils are slightly wind eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen groves, bur oak, shrubs and tall prairie grasses. The majority of these soils are currently utilized for forage and crop production.

In a representative profile of Dobbin soil the solum is approximately 90 cm thick. The profile is characterized by a gray to dark gray Ap horizon, 20 to 35 cm thick, a grayish brown to brown Bm horizon, 40 to 55 cm thick, a dark grayish brown Btj or Bt horizon, 5 to 10 cm thick with clay accumulation and a transitional BC horizon, 15 to 20 cm thick. A typical profile also contains thin strata of VFSL to SiL textures.

Dobbin soils occur in close association with Stockton, Laveham and Sewell soils. They are similar to Halstead soils by having a well drained Dark Gray profile but differ from them in having sandy rather the coarse loamy deposits. Dobbin soils were previously mapped as degraded Black associates of the Stockton Association in the Carberry (1957) soil report.

Druxman Series (DXM)

The Druxman series consists of imperfectly drained Gleyed Black soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, deep, sandy-skeletal (GrS, GrLS), glacio-fluvial deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes and have medium over rapid permeability, moderately slow surface runoff and a medium water table during the growing season. Druxman soils have medium available water holding capacity, medium organic matter content and medium natural fertility. Native vegetation often includes meadow and tall prairie grasses interspersed with willow clumps. The majority of these soils are currently used for grain crop production.

In a representative profile of Druxman soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 15 to 25 cm thick, a dark yellowish brown to olive brown Bm horizon, 20 to 30 cm thick with many, fine, distinct, yellowish brown iron mottles, a transitional dark yellowish brown BC, 5 to 10 cm thick, occasionally a yellowish brown IICca horizon, 5 to 10 cm thick and light yellowish brown IICk horizon with many, large prominent iron mottles.

Druxman soils occur in close association with Croyon and Carvey soils. They are similar to Capell soils by having an imperfectly drained Black profile developed in loamy over sandy-skeletal deposits but differ from Capell soils because Capell soils lack a Bm horizon. Druxman soils were previously mapped as imperfectly drained associates of the Agassiz Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Dugas Series (DGS)

The Dugas series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (40 to 70 cm) of moderately to strongly calcareous, shallow, uniform, clayey (SiC,C), lacustrine deposits over moderately to strongly calcareous, deep, stratified, sandy (FS,LFS,S), and loamy (L,SiL,CL), lacustrine, deposits. These soils occur in middle positions of very gentle slopes on level landscapes and have very slow over moderately slow permeability, moderate surface runoff, and a high water table during the growing season. Dugas soils are non-eroded, non-stony, and occasionally slightly saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen groves, shrubs, tall prairie and meadow grasses. The majority of these soils are currently cultivated for grain production.

In a representative profile of Dugas soil the solum is approximately 15 cm thick. The profile is characterized by a black Ap or Ah horizon, 12 to 15 cm thick, a calcareous, very dark grayish brown AC horizon, 10 to 20 cm thick, a dark grayish brown Ckgj horizon, 15 to 25 cm thick, and a light olive brown IICkg horizon, with many distinct reddish brown mottles.

They are similar to Deadhorse soils by having a Gleyed Rego Black profile and clayey surface mantle but differ from them in having loamy substrate rather than fine loamy substrate. Dugas soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Durnan Series (DRN)

The Durnan series consists of moderately well to well drained Rego Black soil developed on strongly to very strongly calcareous, deep, stratified, coarse loamy (VFSL,L,SiL), lacustrine deposits. These soils occur in upper slope and crest positions of gentle slopes on hummocky to undulating landscapes and have moderate to moderately rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Durnan soils are occasionally slightly eroded, non-stony, and non-saline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak, prairie grasses and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Durnan soil the solum is approximately 10 cm thick. The profile is characterized by a very dark gray Ahk horizon, 10 to 15 cm thick, frequently a Cca horizon, 4 to 7 cm thick and a pale brown, calcareous C horizon.

Durnan soils occur in close association with Fairland, Torcan and Vordas soils. They are similar to Traverse soils by having a well drained profile in coarse loamy deposits but differ from them in having no Bmk horizon. Durnan soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Edkins Series (EDK)

The Edkins series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (40 to 60 cm) of moderately to strongly calcareous, shallow loamy (L,SiL,SiCL,CL), lacustrine deposits over moderately to strongly calcareous, clayey (C,SiC) lacustrine deposits. These soils occur in level to depressional positions of nearly level slopes on level landscapes and have restricted permeability, slow surface runoff, and a high water table during the growing season. Edkins soils are non-eroded, non-stony, and frequently slightly saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, willows and reeds. The majority of these soils are currently under native vegetation.

In a representative profile of Edkins soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray, calcareous Ah horizon, 15 to 30 cm thick, a light gray AC horizon, 8 to 20 cm thick, usually a Cca horizon, 5 to 10 cm thick with lime accumulation and a calcareous C horizon, with mottles and gypsum crystals.

Edkins soils occur in close association with Denham, Graysville and Regnold soils. They are similar to Blumenfeld soils by having a poorly drained profile and loamy surface mantle but differ from them in having a clayey substrate rather than fine loamy substrate. Edkins soils were previously mapped as Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Eigenhof Series (EGF)

The Eigenhof series consists of moderately well to well drained Orthic Black soil developed on moderately to strongly calcareous, deep, stratified, fine loamy (CL,SiCL,CL), lacustrine deposits. These soils occur in upper positions of nearly level to very gentle slopes on undulating landscapes and have moderate to moderately slow permeability, moderate surface runoff, and a low water table during the growing season. Eigenhof soils are non-eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen-oak groves, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Eigenhof soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 15 to 25 cm thick, a grayish brown Bm horizon, 15 to 20 cm thick, a weakly calcareous, transitional BC horizon 5 to 15 cm thick, and a moderately calcareous C horizon, stratified with SiL and SiCL textures. A typical profile also contains thin layers of fine sand to silt below the solum.

Eigenhof soils occur in close association with Neuhorst soils. They are similar to Denham soils by having an Orthic Black profile but differ from them in having no clayey substrate diagnostic of Denham soils. Eigenhof soils were previously mapped as well drained, Blackearth associates of the Rathwell Association in the Carberry (1957) soil report.

Elm Creek Series (EEK)

The Elm Creek series consists of imperfectly drained Gleyed Black soil developed on a mantle (50 to 80 cm) of weakly to moderately calcareous, shallow sandy to coarse loamy (FS,LFS,VFS,LVFS,FSL), lacustrine deposits over moderately calcareous, deep uniform, clayey (SiC,C), lacustrine deposits. These soils occur in middle positions of very gentle slopes on level to undulating landscapes and have rapid over restricted permeability, slow surface runoff, and a high water table during the growing season. Elm Creek soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, aspen-oak groves, and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Elm Creek soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray to dark gray Ah horizon, 18 to 25 cm thick, a grayish brown to dark grayish brown Bmgj horizon, 25 to 40 cm thick with many distinct mottles, frequently a Cca horizon, 10 to 15 cm thick, and a brownish gray to gray IICkg horizon, with distinct yellowish brown mottles.

Elm Creek soils occur in close association with Hibsin, Rosebank and Layland soils. They are similar to Rosebank soils by having an imperfectly drained profile in coarse loamy over clayey deposits but differ from them in having a Bm horizon. Elm Creek soils were previously mapped as associates of the Almasippi clay substrate Association in the Carberry (1957) soil report.

Elm River Series (EMV)

The Elm River series consists of moderately well drained Cumulic Regosol soil developed on moderately calcareous, stratified, loamy (VFSL,L,SiL,SCL,CL,SiCL), recent fluvial deposits. Prior to settlement and drainage control annual flooding caused sediment deposition on the Elm River soils. These soils occur in middle positions of very gentle to gentle slopes on arcuate ridges or meander scrolls, and have moderate permeability, moderate surface runoff, and a high water table during the growing season. Elm River soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes elm, ash, Manitoba maple and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Elm River soil there is no solum development. The profile is characterized by a brownish gray Ap horizon, 5 to 15 cm thick, and a slightly lighter coloured Ck horizon,. A typical profile also contains many buried Ah horizons and is mottled.

Elm River soils occur in close association with Gervais, Poplar Point and Willowbend soils. They are similar to La Salle soils by having well drained profile in recent alluvium but differ from them in having a lighter coloured surface horizon. Elm River soils were previously mapped as associates of the Assiniboine Complex in the Carberry (1957) soil report.

Elm River Series, Sandy Variant (EMV1)

The Elm River series, sandy variant, occurs in close association with normal Elm River soils and differs from the normal soils in having sandy (FS,LFS,S) textures predominate their soil profiles.

Fairland Series (FND)

The Fairland series consists of moderately well to well drained Orthic Black soil developed on strongly to very strongly calcareous, deep, stratified, loamy (VFSL,L,SiL), lacustrine deposits. These soils occur in upper positions of gentle slopes on rolling landscapes and have moderate permeability, moderate surface runoff, and a low water table during the growing season. Fairland soils are often slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Fairland soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ap horizon, 10 to 15 cm thick, a brown to dark brown Bm horizon, 10 to 15 cm thick a pale brown BC horizon, 5 to 10 cm thick with carbonates and a light gray Cca horizon, 5 to 10 cm thick with lime accumulation. The parent material is typically very pale brown and calcareous.

Fairland soils occur in close association with Traverse, Taggart and Vordas soils. They are similar to Durnan soils by having a well developed profile in loamy deposits but differ from them in having a strongly developed Bm horizon. Fairland soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Firdale Series (FIR)

The Firdale series consists of moderately well to well drained Orthic Dark Gray soil developed on moderately to strongly calcareous, deep, fine loamy (SCL,SiCL,L,SiL), lacustrine deposits. These soils occur in upper positions of gentle to moderate slopes on undulating to dissected landscapes and have rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Firdale soils are moderately eroded, non-stony, and non-saline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Firdale soil the solum is approximately 60 cm thick. The profile is characterized by a dark gray Ap horizon, 20 to 30 cm thick, a yellowish Bt horizon, 30 to 45 cm thick with clay accumulation, a Cca horizon, 5 to 10 cm thick, and a calcareous C horizon.

Firdale soils occur in close association with Danlin and Tadpole soils. They are similar to Halstead soils by having a well drained Orthic Dark Gray profile but differ from them in having fine loamy rather than coarse loamy deposits. Firdale soils were previously mapped as Degraded Black associates of the Firdale Association in the Carberry (1957) soil report.

Ferris Series (FRS)

The Ferris series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous deep, uniform, fine loamy and fine silty slightly stony mixed till deposits. These soils occur in lower positions of very gentle slopes on undulating landscape and have moderately slow permeability slow surface runoff and a medium water table during the growing season. Ferris soils are non-eroded, non-stony and slightly saline. They have high available water holding capacity, high organic matter content, and high natural fertility.

In a representative profile of Ferris soil the solum is approximately 30 cm thick. The profile is characterized by black, carbonated Ap horizon, 25 to 35 cm thick, a dark gray, transitional AC horizon, 15 to 30 cm thick with iron mottles, and a light gray to pale yellow Cca horizon 10 to 15 cm thick with lime accumulation. The parent material is typically light yellowish brown mixed till with iron mottles.

Ferris soils occur in close association with Zaplin and Nikkel soils. They are similar to Joyale soils by having a Gleyed Rego Black profile and mixed till at depth but differ because of a fine loamy lacustrine veneer (30 to 90 cm thick) overlying the mixed till. Ferris soils were previously mapped as imperfectly drained blackearth associates of the Pembina association in the reconnaissance soil survey of South-Central Manitoba (1943).

Fifere Series (FFR)

The Fifere series consists of well drained Orthic Dark Gray soil developed on weakly calcareous to neutral, shallow uniform, fine loamy and fine silty (SiL, L, CL) till derived from shale bedrock. These soils occur in upper positions of gentle to moderate slopes on hummocky and ridged landscapes and have moderate permeability moderate to rapid surface runoff and a low water table during the growing season. Fifere soils are moderately eroded. They have low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes oak aspen-popular and shrubs. The majority of these soils are currently used for grain crop production.

In a representative profile of Fifere soil the solum is approximately 70 cm thick. The profile is characterized by a gray brown Ap or Ah horizon, 15 to 18 cm thick, a light brownish gray Bt horizon, 25 to 35 cm thick and a light grayish brown transitional BC horizon, 10 to 30 cm thick. The parent material is typically light grayish brown non-calcareous shale till. A typical profile also contains numerous shale fragments of various size throughout.

Fifere soils occur in close association with Manitou, Nayler and Fresno soils. They are similar to Nayler soils by having a profile developed in well drained, non-calcareous shale till but differ from Nayler soils because of the absence of an Ae horizon greater than 5 cm in thickness. Fifere soils were previously mapped as associates of the Manitou association in the reconnaissance soil survey of South-Central Manitoba (1943).

Fortina Series (FTN)

The Fortina series consists of poorly drained Rego Humic Gleysol soil developed on moderately to very strongly calcareous, deep, stratified, sandy skeletal (S,GrS,GrLS), glacial fluvial deposits. These soils occur in depressional positions of nearly level slopes on level landscapes and have moderately rapid to rapid permeability, very slow surface runoff, and a high water table during the growing season. Fortina soils are non-eroded, non-stony, and frequently slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Fortina soil the solum is approximately 30 cm thick. The profile is characterized by a black Ah horizon, 20 to 30 cm thick, with carbonates, a Cca horizon, 15 to 25 cm thick with many distinct mottles, and a Ckg horizon, with numerous prominent mottles. The parent material is typically stratified with sand and gravel.

Fortina soils occur in close association with Dexter and Dorset soils. They are similar to Sewell soils by having a poorly drained profile with sandy strata but differ from them in having gravelly strata which are absent in Sewell soils. Fortina soils were previously mapped as Meadow associates of the Marringhurst Association in the Carberry (1957) soil report.

Gateside Series (GTD)

The Gateside series consists of imperfectly drained Gleyed Black soil developed on moderately to strongly calcareous, deep, coarse loamy (VFS,LVFS,FSL), lacustrine deposits. These soils occur in middle positions of very gentle to nearly level slopes on undulating landscapes and have moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Gateside soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses aspen-oak groves, shrubs and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Gateside soil the solum is approximately 35 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 12 to 18 cm thick, a brown to olive brown Bm horizon, 15 to 30 cm thick with faint iron mottles, a light olive brown BC horizon, 5 to 15 cm thick with carbonates and a light olive brown to yellowish brown Ck horizon, with distinct yellowish brown mottles.

Gateside soils occur in close association with Prosser, Bone and Poolex soils. They are similar to Pleasant soils by having an imperfectly drained profile in coarse loamy deposits but differ from them in having a Bm horizon. Gateside soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Gervais Series (GVS)

The Gervais series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on moderately to strongly calcareous, deep, stratified, loamy (SiL,L,SiCL,CL), recent fluvial deposits. Flooding is a hazard where drainage has not been improved. These soils occur in middle positions of very gentle slopes on floodplain landscapes and have moderately slow to slow permeability, slow surface runoff, and a high water table during the growing season. Gervais soils are non-eroded, non-stony, and frequently slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes elm, maple, poplar and meadow grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Gervais soil there is no solum development. The profile is characterized by a weakly developed dark gray to gray Ah horizon, 12 to 20 cm thick, and a lighter colored Ck horizon, with stratified FSL and FS textured layers. A typical profile also contains dark coloured buried Ah horizons.

Gervais soils occur in close association with La Salle, Elm River and Willowbend soils. They are similar to Poplar Point soils by having an imperfectly drained profile in loamy deposits but differ from them in having a distinct Ah horizon. Gervais soils were previously mapped as associates of the Assiniboine Complex in the Carberry (1957) soil report.

Gnadenthal Series (GDH)

The Gnadenthal series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, deep stratified, loamy (VFSL,L,SiL), fluvial and lacustrine deposits. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderate permeability, moderately slow surface runoff, and a medium water table during the growing season. Gnadenthal soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Gnadenthal soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black weakly calcareous Ap horizon, 15 to 40 cm thick, a gray to dark gray AC horizon, 7 to 25 cm thick with moderate calcareousness occasionally a Cca horizon, 5 to 10 cm thick with lime accumulation and a C horizon with iron mottles. The parent material is typically stratified with FSL,SiCL and CL textures.

Gnadenthal soils occur in close association with Reinfeld and Blumenfeld soils. They are similar to Neuenberg soils by having a Gleyed Rego Black profile and loamy surface but differ from them in having a finer textured subsurface. Gnadenthal soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Graysville Series (GYV)

The Graysville series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 90 cm) of moderately to strongly calcareous, loamy (VFSL,L,SiL,SiCL,CL), fluvial and lacustrine deposits over moderately calcareous, clayey (C,SiC), lacustrine deposits. These soils occur in middle positions of nearly level slopes on undulating landscapes and have moderate over very slow permeability, slow surface runoff, and a high water table during the growing season. Graysville soils are non-eroded, non-stony, and occasionally slightly saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie grasses, willows, maples and aspen. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Graysville soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 40 cm thick, an AC horizon, 8 to 20 cm thick with moderate calcareousness, occasionally a Cca horizon, 5 to 8 cm thick and a IICk horizon, with many distinct mottles. A typical profile also contains gypsum in the lower C horizon.

Graysville soils occur in close association with Denham, Rignold and Edkins soils. They are similar to Rigold soils by having the same drainage and materials but differ from them in having no diagnostic Bm horizon. Graysville soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Guerra Series (GRR)

The Guerra series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (35 to 100 cm) of moderately to strongly calcareous, uniform, fine loamy (CL, L, SiCL), lacustrine deposits over moderately to strongly calcareous, deep, uniform, fine loamy (CL, L, SiCL), mixed till deposits. These soils occur in level to depressional positions of very gentle slopes on hummocky landscapes and have slow permeability very slow surface runoff and a high water table during the growing season. Guerra soils are occasionally slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation often includes sedges, rushes and willows. The majority of these soils are currently used for natural grazing.

In a representative profile of Guerra soil the solum is approximately 25 cm thick. The profile is characterized by a black Ah or Ahk horizon, 15 to 30 cm thick, a very dark gray transitional AC horizon, 5 to 15 cm thick with many prominent iron mottles, and a dark olive gray Ck horizon with many prominent iron mottles. The parent material is relatively free of coarse fragments.

Guerra soils occur in close association with Knudson, Joyale and Ullrich soils. They are similar to Narish soils by having a Rego Humic Gleysol profile developed in mixed calcareous till but differ from Narish soils because Narish profiles are associated with Dark Gray soils while Guerra profiles are associated with Black soils. Guerra soils were previously mapped as the poorly drained blackearth associate of the Altamont association, in the reconnaissance soil survey of South-Central Manitoba (1943).

Grover Series (GRO)

The Grover series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), lacustrine deposits over moderately calcareous, deep, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Grover soils are non-eroded, non-stony, and non-saline. They have medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen oak, ash and tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Grover soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to black Ah or Ahk horizon, 15 to 25 cm thick, a dark grayish brown AC horizon, 15 to 20 cm thick with faint mottles, a Cca horizon, 5 to 8 cm thick, and a light yellowish brown, sandy Ck horizon, with yellowish brown mottles.

Grover soils occur in close association with Glenboro and Grayson soils. They are similar to Crookdale soils by having an imperfectly drained profile with a sandy substrate but differ from them in having a loamy rather than fine loamy surface. Grover soils were previously mapped as Black Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Glenboro Series (GBO)

The Glenboro series consists of moderately well to well drained Orthic Black soil developed on a mantle (25 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), lacustrine deposits over moderately calcareous, stratified, deep, sandy (FS,LFS,LS) deposits. These soils occur in upper positions of gentle slopes on sloping to undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a low water table during the growing season. Glenboro soils are often slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Glenboro soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 12 to 18 cm thick, with granular structure, a dark brown to brown Bm or Btj horizon, 10 to 16 cm thick with subangular blocky structure, a brown to pale brown BC horizon, 6 to 14 cm thick and a light gray to very pale brown Cca horizon, 5 to 8 cm thick. The parent material is typically pale brown to light yellowish brown sandy. Some stratified sands to loams may occur in the loam/sand transition.

Glenboro soils occur in close association with Grover and Grayson soils. They are similar to Fairland soils by having an Orthic Black profile and loamy surface mantle but differ from them in having a sandy substrate. Glenboro soils were previously mapped as Blackearth associates of the Glenboro Association in the Carberry (1957) soil report.

Grayson Series (GYS)

The Grayson series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (25 to 95 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), deposits over moderately calcareous, deep, sandy (FS,LFS,LS), deposits. These soils occur in depressional positions of very gentle slopes on undulating landscapes and have moderate permeability, very slow surface runoff, and a high water table during the growing season. Grayson soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes rushes, reeds, sedges and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Grayson soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah or Ahk horizon, 8 to 12 cm thick, a dark gray AC horizon, 10 to 15 cm thick and frequently light gray Cca horizon, 5 to 8 cm thick with lime accumulation. The parent material is typically light olive brown to olive. A typical profile also contains mottles in the AC and Ck horizons.

Grayson soils occur in close association with Glenboro and Grover soils. They are similar to Vordas soils by having poor drainage and a loamy surface but differ from them in having a sandy substrate. Grayson soils were previously mapped as Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Halstead Series (HAT)

The Halstead series consists of well to moderately well drained Orthic Dark Gray soil developed on weakly calcareous, deep, stratified, coarse loamy and coarse silty (FSL,VFS,LVFS,VFSL,L,SiL), lacustrine deposits. These soils occur in upper positions of very gentle to gentle slopes on hummocky landscapes and have moderate to moderately rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Halstead soils are frequently moderately eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, scrub oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Halstead soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah or Ap horizon, 20 to 30 cm thick, a weakly developed brown Bm horizon, 15 to 25 cm thick, a prominent brown Bt horizon, 5 to 10 cm thick and a brown Ck or Ckgj horizon. A typical profile also contains thin layers of SiCL and SiL textures.

Halstead soils occur in close association with Bone and Poolex soils. They are similar to Firdale soils by having an Orthic Dark Gray profile but differ from them in having coarse loamy rather than fine loamy deposits. Halstead soils were previously mapped as coarser associates of the Firdale Association in the Carberry (1957) soil report.

Hebbot Series (HEB)

The Hebbot series consists of well drained Rego Black soil developed on strongly to very strongly calcareous, deep, uniform, loamy (L,CL,SiCL), glacial till deposits derived from limestone, granite and shale. These soils occur in upper and crest positions of moderate to strong slopes on hummocky landscapes and have moderate to moderately rapid permeability, moderate surface runoff, and a low water table during the growing season. Hebbot soils are severely water eroded, slightly stony, and non-saline. They have a medium available water holding capacity, low organic matter content, and medium natural fertility. Native vegetation includes scrub oak, aspen, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain and forage production.

In a representative profile of Hebbot soil the solum is eroded. The profile is characterized by a dark gray to very dark gray Ah horizon, 10 to 15 cm thick, a brown to pale brown Cca horizon, 10 to 15 cm thick, and a yellowish brown Ck horizon.

Hebbot soils occur in close association with Darlingford, Nikkel and Cazlake soils. They are similar to Darlingford soils by having a well drained profile in loamy till but differ from them in having no Bm horizon. Hebbot soils were previously mapped as Calcareous Black associates of the Darlingford Association in the South Central (1943) soil report.

Hibsin Series (HIN)

The Hibsin series consists of moderately well drained Orthic Black soil developed on a mantle (40 to 90 cm) of weakly to moderately calcareous, shallow, coarse loamy (LVFS,VFS,FSL), lacustrine deposits over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine deposits. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderately rapid over slow permeability, moderate surface runoff, and a low water table during the growing season. Hibsin soils are non-eroded, non-stony, and non-saline. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes aspen oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Hibsin soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray to dark gray Ah horizon, 15 to 25 cm thick, a brown Bm horizon, 20 to 30 cm thick, a Cca horizon, 8 to 13 cm thick with lime accumulation and a Ck horizon. A typical profile is usually developed entirely in the coarser material.

Hibsin soils occur in close association with Rosebank and Layland soils. They are similar to Hochfeld soils by having an Orthic Black profile in coarse loamy deposits but differ from them in having a clayey substrate. Hibsin soils were previously mapped as associates of the Almasippi clay substrate Association in the Carberry (1957) soil report.

Hochfeld Series (HHF)

The Hochfeld series consists of moderately well drained Orthic Black soil developed on moderately calcareous, coarse loamy (VFS,LVFS,FSL<SL), lacustrine deposits. These deposits range in thickness from 1.5 to 5 meters over finer textured lacustrine sediments. These soils occur in upper positions of very gentle slopes

on undulating landscapes and have moderately rapid permeability, moderate surface runoff, and a low water table during the growing season. Hochfeld soils are often slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Hochfeld soil the solum is approximately 50 cm thick. The profile is characterized by a dark gray to very dark gray Ah horizon, 15 to 25 cm thick, a brown Bm horizon, 15 to 40 cm thick, usually a light brown Cca horizon, 5 to 8 cm thick, and a brown Ck horizon, with many faint mottles.

Hochfeld soils occur in close association with Reinland and Osterwick soils. They are similar to Hibsin soils by having an Orthic Black profile and coarse loamy surface but differ from them in having no clayey substrate. Hochfeld soils were previously mapped as Blackearth associates of the Almasippi Association in the Carberry (1957) soil report.

Horose Series (HOS)

The Horose series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, fine loamy and coarse loamy (L, CL, SICL) mixed till of limestone, granite and shale origin. These soils occur in level to depressional positions of moderate slopes on hummocky landscapes and have very slow permeability very slow surface runoff and a high water table during the growing season. Horose soils are non-eroded, slightly stony and slightly saline. They have medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation often includes sedges, reeds and willows. The majority of these soils are currently under natural conditions.

In a representative profile of Horose soil the solum is approximately 25 cm thick. The profile is characterized by a black Ah or Ahk horizon, 20 to 35 cm thick, a light olive brown AC horizon, 5 to 10 cm thick, and a light yellowish brown Ck horizon with many, large, prominent iron mottles. A typical profile also contains a Cca horizon, 5 to 10 cm thick below the AC horizon.

Horose soils occur in close association with Dezwood, Pembina and Zaplin soils. They are similar to Cazlake soils by having the same Rego Humic Gleysol profile development and poor drainage but differ from Cazlake soils because the Horose series is associated with Dark Gray soils while the Cazlake series is associated with Black soils. Horose soils were previously mapped as poorly drained associates of the Pembina association, in the reconnaissance soil survey of South-Central Manitoba (1943).

Hummerston Series (HMO)

The Hummerston series consists of imperfectly drained Gleyed Rego Black soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine and fluvial deposits. These soils occur in middle to lower positions of very gentle slopes on undulating landscapes and have moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Hummerston soils are often slightly wind eroded, non-stony, and slightly saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen-oak groves, shrubs, tall prairie and meadow grasses. The majority of these soils are currently cultivated for forage and grain crops. In a representative profile of Hummerston soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 20 cm thick, a dark gray AC horizon, 10 to 18 cm thick with moderate calcareousness, and a yellowish brown Ck horizon, with prominent yellow mottles.

Hummerston soils occur in close association with Stockton, Lavenham and Sewell soils. They are similar to Lavenham soils by having an imperfectly drained profile in sandy deposits but differ from them in having no diagnostic Bm Horizon. Hummerston soils were previously mapped as Black Meadow associates of the Stockton Association in the Carberry (1957) soil report.

Janick Series (JIK)

The Janick series consists of well to moderately well drained Orthic Black soil developed on moderately to strongly calcareous, deep, uniform, clayey (C,SiC), lacustrine deposits. These soils occur in upper positions of nearly level slopes on undulating landscapes and have slow permeability, moderately slow surface runoff, and a medium water table during the growing season. Janick soils are non-eroded, non-stony, and non-saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Janick soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 10 to 18 cm thick, a dark grayish brown to brown Bm horizon, 8 to 15 cm thick with fine subangular blocky structure, a pale brown BC horizon, 5 to 10 cm thick with weak calcareousness and a light grayish brown to pale brown Ck horizon, with a few faint mottles.

Janick soils occur in close association with Harding and Lowton soils. They are similar to Winkler soils by having a well drained profile in clayey deposits but differ from them in having no stratified fine loamy deposits in the substrata. Janick soils were previously mapped as Blackearth associates of the Harding Association in the Carberry (1957) soil report.

Jasset Series (JST)

The Jasset series consists of imperfectly drained Gleyed Black soil developed on a mantle (70 to 90 cm) of moderately to strongly calcareous, shallow loamy (VFSL,L,SiL,SCl), lacustrine deposits over moderately calcareous, stratified, deep, sandy (FS,LFS,VFS) lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, slow surface runoff, and a high water table during the growing season. Jasset soils are non-eroded, non-stony, and occasionally slightly saline. They have medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, maple and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Jasset soil the solum is approximately 60 cm thick. The profile is characterized by a very dark gray to black Ap horizon, 25 to 35 cm thick, a brown to yellowish brown Bm horizon, 25 to 40 cm thick with fine, faint mottles, a carbonated BC horizon, 10 to 15 cm thick and a Cca horizon, 5 to 10 cm thick. A typical profile also contains a calcareous C horizon with prominent mottles.

Jasset soils occur in close association with Neuenberg and Rosengart soils. They are similar to Neuenberg soils by having an imperfectly drained profile in loamy over sandy deposits, but differ from them in having a prominent Bm horizon. Jasset soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Joyale Series (JYL)

The Joyale series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, fine loamy (L, CL, SICL), lacustrine deposits over moderately to very strongly calcareous, deep uniform, fine loamy (CL, SICL), mixed till deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes and have moderate permeability slow surface runoff and a medium water table during the growing season. Joyale soils are usually slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Joyale soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to black Apk or Ahk horizon, 15 to 25 cm thick, a light gray Cca or AC horizon, 5 to 15 cm thick with distinct iron mottles, and a very pale brown IICk horizon with many prominent iron mottles. A typical profile also contains a thin pebble line at the lacustrine/till contact.

Joyale soils occur in close association with Knudson, Ullrich and Guerra soils. They are similar to Prodan soils by having a Gleyed Rego Black profile developed dominantly in imperfectly drained fine loamy deposits but differ from Prodan soils because of the presence of a compact till substrate within a meter of the mineral surface. Joyale soils were previously mapped as minor, imperfectly drained blackearth associates of the Altamont association in the reconnaissance soil survey of South-Central Manitoba (1943).

Kerran Series (KRN)

The Kerran series consists of poorly to very poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, stratified, clayey (SiC,C), recent alluvial deposits with strata of silty clay loam and clay loam textures. These soils occur in depressional positions of level slopes on flood-prone terraced landscapes and have very slow permeability, very slow surface runoff, and a high water table during the growing season. Kerran soils are non-eroded, non-stony, and frequently moderately saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes reeds, rushes, sedges and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Kerran soil the solum is not developed. The profile is characterized by a thin organic horizon, 2 to 4 cm thick, a weakly developed dark gray Ahk horizon, 10 to 15 cm thick, and a pale brown to light gray C horizon, with prominent iron mottles. The parent material is typically stratified, mottled, and may contain buried former Ah horizons.

Kerran soils occur in close association with Assiniboine soils. They are similar to Barker soils by having a poorly drained profile in recent alluvium but differ from them in having finer textures throughout the profile. Kerran soils were previously mapped as associates of the Assiniboine Complex in the Carberry (1957) soil report.

Kingsley Series (KIS)

The Kingsley series consists of moderately well to well drained Orthic Dark Gray Luvisol soil developed on a mantle (25 to 100 cm) of weakly to moderately calcareous, uniform, fine loamy (CL, SiCL), lacustrine deposits over moderately to strongly calcareous, deep, uniform, fine loamy (CL, L), mixed till deposits. These soils occur in upper slope positions of very gentle slopes on hummocky landscapes and have moderate permeability, moderate surface runoff and a low water table during the growing season. Kingsley soils are slightly water eroded. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation often includes forests of bur-oak and aspen. The majority of these soils are currently used for grain crop production.

In a representative profile of Kingsley soil the solum is approximately 60 cm thick. The profile is characterized by a grayish brown Ahe or Ap horizon, 10 to 20 cm thick, a light gray Ae horizon, 10 to 15 cm thick with fine platy structure, a light yellowish brown, transitional AB horizon, 10 to 25 cm thick, a pale brown Bt horizon, 5 to 15 cm thick with clay skins, a light yellowish brown transitional IIBC horizon, 10 to 20 cm thick, and a very pale brown IICk horizon. The till substrate is commonly mixed till but can also be dominantly shaley till.

Kingsley soils occur in close association with Altamont soils. They are similar to Trinton soils by having a Orthic Dark Gray Luvisol profile developed dominantly in fine-loamy lacustrine deposits, but differ from Trinton soils in not having a sandy-skeletal substrate within a meter of the mineral surface. Kingsley soils were previously mapped as gray-wooded associates of the Altamont association in the reconnaissance soil survey of South-Central Manitoba (1943).

Knudson Series (KUD)

The Knudson series consists of moderately well to well drained Orthic Black soil developed on a shallow mantle (30 to 100 cm) of weakly to moderately calcareous thin, uniform, fine loamy to clayey, glaciolacustrine deposit, over moderately to strongly calcareous, deep, uniform, fine loamy to fine silty mixed till deposits. These soils occur in middle positions of very gentle slopes on undulating landscape and have medium permeability, moderate surface runoff and a medium water table during the growing season. Knudson soils have moderate available water holding capacity, moderate organic matter content, and high natural fertility.

In a representative profile of Knudson soil the solum is approximately 60 cm thick. The profile is characterized by a black Ap horizon, 15 to 25 cm thick, with a brown to grayish brown Bm horizon 8 to 12 cm thick with medium subangular blocky structure, a very pale brown Cca horizon 6 to 10 cm thick, and a yellowish brown IICk horizon. A typical profile also contains a thin pebble line at the lacustrine-till interface.

Knudson soils occur in close association with Joyale and Guerra soils. They are similar to Darlingford soils by having similar profile characteristics but differ from them in having a thin mantle of fine loamy to clayey glaciolacustrine deposits overlying glacial till. Knudson soils were previously mapped as blackearth associates of the Altamont association in the reconnaissance soil survey of South-Central Manitoba (1943).

Kronstal Series (KOT)

The Kronstal series consists of imperfectly drained Gleyed Black soil developed on moderately calcareous, deep, stratified, coarse loamy (VFS,LVFS,FSL,SL), lacustrine deposits. These soils occur in middle positions of nearly level slopes on undulating landscapes and have moderate to moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Kronstal soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes aspen-oak groves, shrubs, meadow and tall prairie grasses. The majority of these soils are currently cultivated for grain crop production. In a representative profile of Kronstal soil the solum is approximately 55 cm thick. The profile is characterized by a very dark gray Ah horizon, 20 to 30 cm thick, a grayish brown to brown Bm horizon, 20 to 40 cm thick with fine to medium yellowish mottle, a Cca horizon, 8 to 13 cm thick and a C horizon, with distinct mottles. The parent material is typically stratified with layers of FS to LFS texture.

Kronstal soils occur in close association with Hochfeld, Reinland and Osterwick soils. They are similar to Jasset soils by having a Gleyed Black profile and coarse loamy substrate but differ from them in having no loamy surface mantle. Kronstal soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

La Salle Series (LSL)

The La Salle series consists of moderately well drained Cumulic Regosol soil developed on moderately to strongly calcareous, deep, stratified, loamy (l,SiL,SiCL,CL), recent alluvial sediments. These soils occur in upper positions of gentle slopes on meander scrolls and levee landscapes and have moderate permeability, moderate surface runoff, and a low water table during the growing season. La Salle soils are slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes elm, ash, basswood and maple. The majority of these soils are currently cultivated for forage and grain crops.

In a representative profile of La Salle soil the solum is not developed. The profile is characterized by a weakly developed, dark gray Ah horizon, 5 to 15 cm thick, and a grayish brown Ck horizon, with strata of (SiL,SiCL,VFS and FS) textures.

La Salle soils occur in close association with Poplar Point, Gervais and Willowbend soils. They are similar to Elm River soils by having a Cumulic Regosol profile on loamy alluvium but differ from them in having a more prominent, darker coloured surface. La Salle soils were previously mapped as well drained associates of the Agassiz Complex in the Carberry (1957) soil report.

La Salle Series, Sandy Variant (LSL)

The La Salle series, sandy variant, occurs in close association with normal La Salle soils . It differs from the normal soil in having dominantly sandy (FS,LFS,S) textures throughout its profile.

Layland Series (LAY)

The Layland series consists of poor drained Rego Humic Gleysol soil developed on a mantle (30 to 90 cm) of strongly calcareous, stratified, shallow, sandy (FS,LFS) to coarse loamy (VFS,LVFS,FSL), deposits over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine deposits. These soils occur in depressional positions of nearly level slopes on undulating landscapes and have moderately rapid over very slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Layland soils are non-eroded, non-stony, and often slightly saline. They have medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, seeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Layland soil the solum is approximately 25 cm thick. The profile is characterized by very dark gray Ah horizon, 15 to 35 cm thick, with moderate calcareousness, an AC horizon, 7 to 20 cm thick with moderate calcareousness, a Cca horizon, 5 to 8 cm thick with a Ckg horizon. A typical profile also contains a peaty surface layer 5 to 15 cm thick.

Layland soils occur in close association with Hibsin, Rosebank and Elm Creek soils. They are similar to Osterwick soils by having a poorly drained profile in coarse loamy deposits but differ from them in having no clayey substrate. Layland soils were previously mapped as associates of Almasippi clay substrate Association in the Carberry (1957) soil report.

Leary Series (LRY)

The Leary series consists of well to rapidly drained Orthic Dark Gray soil developed on moderately to strongly calcareous, deep, stratified, sandy to sandy-skeletal (LCS, GrLS), glaciofluvial deposits. These soils occur in middle to upper slope positions of moderate slopes on hummocky landscapes and have very rapid permeability moderate surface runoff and a low water table during the growing season. Leary soils have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation often includes forests of dominantly burr oak. The majority of these soils are currently excavated for road construction and the aggregate industry.

In a representative profile of Leary soil the solum is approximately 50 cm thick. The profile is characterized by a dark gray Ah or Ap horizon, 10 to 20 cm thick, a dark brown Bt or Btj horizon, 5 to 20 cm thick, a brown transitional BC horizon, 15 to 30 cm thick and a light yellowish brown Ck horizon with thin layers of coarse sand, fine sand and gravel

Leary soils are similar to Vandal soils by having an Orthic Dark Gray soil profile and sandy-skeletal substrate material but differ from Vandal soils in not having 25 to 100 cm of loamy surface over the sandy-skeletal substrate. Leary soils were previously mapped as the dominant associate of the Leary association in the reconnaissance soil survey of South-Central Manitoba (1943).

Levine Series (LEI)

The Levine series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on moderately to strongly calcareous, deep, stratified, coarse loamy to fine loamy (VFSL, L, CL) recent alluvial deposits. These soils occur in flood plains on level slopes in level landscapes. They have rapid permeability, moderately slow surface runoff and a medium water table during the growing season. Levine soils are occasionally slightly saline and are subject to periodic inundation during spring runoff or after heavy rains. They have a moderate to low available water holding capacity, low organic matter content and medium natural fertility. The majority of these soils are currently used for grain crop production.

In a representative profile of Levine soil the solum is approximately 15 cm thick. The profile is characterized by a dark gray Apk or Ahk horizon 10 to 20 cm thick and a light yellowish brown Ck horizon. The underlying strata may vary in colour from light to dark. The thin dark colored mineral and organic layers are former surface horizons that have been exposed to soil forming processes for a significant period before burial by alluvial deposits. Medium, distinct yellowish brown iron mottles occur through the soil.

Levine soils were previously mapped as inclusions of Eroded Slope Complexes in the reconnaissance soil survey of South-Central Manitoba.

Lelant Series (LLT)

The Lelant series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in level to depressional positions of very gentle slopes on beach-back beach landscapes and have rapid but restricted permeability, very slow surface runoff, and a high water table during the growing season. Lelant soils are non-eroded, non-stony, and frequently slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes reeds, sedges, rushes and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Lelant soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 5 to 10 cm thick, a very dark gray to black Ah horizon, 8 to 15 cm thick, a transitional AC horizon, 5 to 10 cm thick, and a Cca horizon, 5 to 8 cm thick is frequently present.

Lelant soils occur in close association with Skelding, Longplain and Almasippi soils. They are similar to Osterwick soils by having a poorly drained Rego Humic Gleysol profile but differ from them in having sandy rather than coarse loamy deposits. Lelant soils were previously mapped as Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Long Plain Series (LOP)

The Long Plain series consists of imperfectly drained Gleyed Regosol soil developed on weakly to moderately calcareous, deep, uniform, sandy (LFS,FS), wind-modified, deltaic deposits. These soils occur in middle positions of gentle slopes on undulating landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Long Plain soils are severely wind eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes scrub oak, aspen, shrubs and prairie grasses. The majority of these soils are currently used for pasture.

In a representative profile of Long Plain soil the solum is not developed. The profile is characterized by a dark gray to gray Ap horizon, 10 to 25 cm thick, a leached C horizon, 60 to 90 cm thick, and a calcareous C horizon, with prominent mottles. A typical profile also contains a dark gray layer, 5 to 15 cm thick within a meter of the surface.

Long Plain soils occur in close association with Skelding, Almasippi and Lelant soils. They are similar to Willowcrest soils by having an imperfectly drained profile in sandy deposits but differ from them in having no profile development. Long Plain soils were previously mapped as associates of the Almasippi Association in the Carberry (1957) soil report.

Loewen Series (LEW)

The Loewen series consists of poorly drained Rego Humic Gleysol soil developed on non to weakly calcareous, stratified, loamy (CL,L,) fluvial deposits derived from till and shale materials.

These soils occur in depressional positions of gentle slopes on flood prone landscapes and have restricted permeability, very slow surface runoff, and a high or ponded water table during the growing season. Loewen soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, reeds, rushes and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Loewen soil there is no solum development. The profile is characterized by a mixed peaty-mineral surface horizon, 10 to 15 cm thick, a thin, carbonated Ah horizon, 5 to 15 cm thick, and a olive gray Ckg horizon, with variable textures. A typical profile also contains buried surface layers at various depth.

Loewen soils occur in close association with Chortitz soils. They are similar to Willowbend soils by having a poorly drained profile in alluvium but differ from them in having dominantly loamy textures. Loewen soils were previously mapped as associates of the Assiniboine Complex in the Carberry (1957) soil report.

Mansfield Series (MFI)

The Mansfield series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, stratified, deep, sandy skeletal (S,GrS,CS), glaciofluvial deposits. These soils occur in middle positions of nearly level slopes on level landscapes and have rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Mansfield soils are non-eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes prairie grasses, shrubs, aspen and bur oak. The majority of these soils are currently used for grasing or forage crops.

In a representative profile of Mansfield soil the solum is apprximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 25 cm thick, a dark gray to grayish brown AC horizon, 8 to 15 cm thick with moderate calcareousness, a Cca horizon, 5 to 8 cm thick with lime accumulation and a C horizon, with distinct yellowish brown mottles.

Mansfield soils occur in close association with Dorset and Fortina soils. They are similar to Dexter soils by having an imperfectly drained profile in sandy skeletal deposits but differ from them in having no Bm horizon. Mansfield soils were previously mapped as associates of the Marringhurst and Agassiz Associations in the South-Central or Carberry soil reports.

Mansfield Series, Shaly Variant (MFI1)

The Mansfield series, shaly variant, occures in close association with Mansfield soils and differs from them in having varying amounts of shaly fragments throughout the profile.

Marringhurst Series (MRH)

The Marringhurst series consists of moderately well to well drained Calcareous Black soil developed on moderately strongly to strongly calcareous, stratified, deep, sandy (CS,S,LS) and sandy skeletal (GrS,GrCS) glaciofluvial deposits. These soils occur in upper positions of very gentle slopes on rolling to irregular landscapes and have very rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Marringhurst soils are often moderately eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes shrubs, bur oak, and prairie grasses. The majority of these soils are currently excavated for gravel or used for grasing.

In a representative profile of Marringhurst soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ah horizon, 14 to 18 cm thick, a dark brown to brown Bmk horizon, 10 to 18 cm thick, a Cca horizon, 20 to 30 cm thick with coarser gravelly strata and a Ck horizon.

Marringhurst soils occur in close association with Dorset, Dexter and Fortina soils. They are similar to Dorset soils by having a well drained profile in sandy skeletal deposits but differ from them in having a Bmk rather than Bm horizon. Marringhurst soils were previously mapped as the dominant associate of the Marringhurst in the Carberry (1957) soil report.

Mockry Series (MKY)

The Mockry series consists of poorly drained Rego Humic Gleysol soil developed on weakly to noncalcareous, stratified, deep, sandy (FS,LFS,S) eolian deposits. These soils occur in depressional positions of moderate slopes on hummocky landscapes and have rapid permeability, slow surface runoff, and a high water table during the growing season. Mockry soils are non-eroded, nonstony, and often slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes rushes, sedges, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Mockry soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 10 cm thick, an olive gray AC horizon, 10 to 15 cm thick with moderate calcareous and frequently a Cca horizon, 5 to 8 cm thick. The parent material is typically olive gray and mottled.

Mockry soils occur in close association with Shilox and Onahan soils. They are similar to Sewell soils by having a poorly drained profile in sandy deposits but differ from them in having deposits of eolian rather than lacustrine origin. Mockry soils were previously mapped as Meadow associations of the Stockton Association in the Carberry (1957) soil report.

Narish Series (NSH)

The Narish series consists of poorly drained Rego Humic Gleysol soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, fine loamy (CL, L, SICL), lacustrine deposits over moderately to strongly calcareous, deep, uniform, fine loamy (CL, L, SICL), mixed till deposits. These soils occur in level to depressional positions of very gentle slopes on hummocky landscapes and have slow permeability very slow surface runoff and a high water table during the growing season. Guerra soils are occasionally slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation often includes sedges, rushes and willows. The majority of these soils are currently used for natural grazing.

In a representative profile of Guerra soil the solum is approximately 25 cm thick. The profile is characterized by a black Ah or Ahk horizon, 15 to 30 cm thick, a very dark gray transitional AC horizon, 5 to 15 cm thick with many, fine, prominent iron mottles, and a dark olive gray C horizon with many, fine prominent, iron mottles. The parent material is typically relatively free of coarse fragments.

Narish soils occur in close association with Altamont and Tellier soils. Narish soils are virtually the same as Guerra soils differing from them only because they occur in close association with Dark Gray soils found in locally more cool soil climate areas. Narish soils were previously mapped as poorly drained minor associates of the Altamont association in the reconnaissance soil survey of South-Central Manitoba (1943).

Nayler Series (NYO)

The Nayler series consists of well to rapidly drained Orthic Dark Gray Luvisol soil developed on weakly calcareous to neutral, uniform, deep, fine loamy to fine silty (SIL, L, CL), glacial till of shale bedrock origin. These soils occur in upper slope and crest positions of gentle to moderate slopes on hummocky to ridged landscapes and have rapid permeability rapid surface runoff and a low water table during the growing season. Nayler soils are slightly eroded, slightly stony and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation often includes forests of burr oak and aspen poplar. The majority of these soils are currently used for improved pasture and forage crop production.

In a representative profile of Nayler soil the solum is approximately 90 cm thick. The profile is characterized by a gray brown Ap or Ah horizon, 15 to 20 cm thick, a light yellowish brown Ae horizon, 5 to 30 cm thick with fine, platy structure, a light yellowish gray Bt horizon 20 to 60 cm thick with thin clay skins and a yellowish brown non-calcareous C horizon. The parent material is typically composed of gray shaly till containing weathered Odanah shale fragments.

Nayler soils occur in close association with Fifere and Fresno soils. They are similar to Fifere soils by having well drained profiles developed in non-calcareous shale till but differ from Fifere soils by possessing Ae horizons below their Ap or Ahe horizons at least 5 cm thick. Nayler soils were previously mapped as gray-wooded associates of the Snowflake association in the reconnaissance soil survey of South-Central Manitoba (1943).

Neuenberg Series (NBG)

The Neuenberg series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (70 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,SCL,L,SiL), fluvial and lacustrine deposits over moderately calcareous, stratified, deep, coarser (LFS,FS,VFS,LVFS), lacustrine deposits. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderate over rapid permeability, moderate to moderately slow surface runoff, and a high water table during the growing season. Neuenberg soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Neuenberg soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 25 cm thick, with moderate calcareousness, an AC horizon, 10 to 20 cm thick, frequently a Cca horizon, 5 to 8 cm thick, and a Ck horizon, with many distinct mottles. A typical profile also contains VFSL,L and SCL textures grading to L, VFS and FS with depth.

Neuenberg soils occur in close association with Rosengart, Jasset and St. Claude soils. They are similar to Gnadenthal soils by having a Gleyed Rego Black profile and loamy surface mantle but differ from them in having coarser textures rather than finer textures at depth. Neuenberg soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Neuhorst Series (NUH)

The Neuhorst series consists of imperfectly drained Gleyed Rego Black soil developed on moderately calcareous, deep, uniform, fine loamy (SCL,CL,SiCL), fluvial and lacustrine deposits. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderately slow to slow permeability, slow surface runoff, and a medium water table during the growing season. Neuhorst soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, prairie-meadow grasses and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Neuhorst soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 25 to 40 cm thick, with weak calcareousness, a dark gray to gray AC horizon, 8 to 20 cm thick, frequently a light gray Cca horizon, 10 to 15 cm thick with lime accumulation and a light gray to pale yellow C horizon, with many distinct mottles. A typical profile also contains gypsum crystals below the AC or Cca horizon.

Neuhorst soils occur in close association with Eigenhof soils. They are similar to Newton Siding soils by having Gleyed Rego Black profile and fine loamy surface but differ from them in having no sandy substrate. Neuhorst soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Newton Siding Series (NWN)

The Newton Siding series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (40 to 90 cm) of moderately to strongly calcareous, shallow fine loamy (SCL,CL,SiCL), fluvial and lacustrine deposits over moderately calcareous, stratified, deep, sandy (LFS,FS), fluvial and lacustrine deposits. These soils occur in middle positions of nearly level slopes on undulating landscapes and have moderately slow over moderately rapid permeability, slow surface runoff, and a high water table during the growing season. Newton Siding soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie-meadow grasses, shrubs and tall-prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Newton Siding soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ah horizon, 25 to 40 cm thick, with weak calcareousness, a gray AC horizon, 8 to 20 cm thick with moderate calcareousness, a Cca horizon, 10 to 15 cm thick is often present, and a IICk horizon, with prominent mottles.

Newton Siding soils occur in close association with Edenberg soils. They are similar to Neuhorst soils by having an imperfectly drained profile developed in fine loamy deposits but differ from them in having a sandy substrate. Newton Siding soils were previously mapped as inclusions of the Rathwell Association in the Carberry (1957) soil report.

Onahan Series (ONH)

The Onahan series consists of imperfectly drained Gleyed Regosol soil developed on weakly to noncalcareous, deep, sandy (FS,LS,S), eolian deposits. These soils have been stabilized for over 60 years as indicated by tree growth. They occur in lower or middle positions of moderate to strong slopes on hummocky duned landscapes and have rapid permeability, slow surface runoff, and a medium water table during the growing season. Onahan soils are wind eroded, nonstony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen, oak, black spruce and meadow grasses. The majority of these soils are currently used for natural grazing.

In a representative profile of Onahan soil there is no solum development. The profile is characterized by a partially decomposed LH horizon, 1 to 3 cm thick, a gray to dark gray Ah horizon, 5 to 18 cm thick, and a pale brown C horizon, with strong brown to yellowish brown mottles.

Onahan soils occur in close association with Shilox and Mockry soils. They are similar to Hummerston soils by having sandy deposits and imperfect drainage but differ from them in having no Chernozemic A horizon. Onahan soils were previously mapped as immature associates of the Stockton Association in the Carberry (1957) soil report.

Oakley Series (OAY)

The Oakley series consists of moderately well to well drained Orthic Dark Gray soil developed on a mantle (25 to 90 cm) of moderately to very strongly calcareous, shallow loamy (CL,SiCL), till of shale, limestone and granitic origin over weakly to noncalcareous, weathered, Odanah, siliceous, shale bedrock. These soils occur in crest and upper positions of moderate to strong slopes on inclined, undulating and hummocky landscapes, and have moderate permeability, moderate to rapid surface runoff, and a low water table during the growing season. Oakley soils are often severely water eroded, slightly stony, and non-saline. They have a medium available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen, oak, ash and mixed grasses. The majority of these soils are currently used for natural grasing

In a representative profile of Oakley soil the solum is approximately 40 cm thick. The profile is characterized by dark gray Ah horizon, 15 to 20 cm thick, a Bm or Btj horizon, 20 to 30 cm thick and a calcareous C horizon. Oakley soils are similar to Dezwood soils by having a well drained profile in mixed till but differ from them in having bedrock within a meter of the surface. Oakley soils were previously mapped as minor inclusions of the Pembina Association in the South-Central (1943) soil report.

Osborne Series (OBO)

The Osborne series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, stratified, clayey (SiC,C,HC), fluvial and lacustrine deposits. Although Osborne soils are dominantly associated with deep uniform clayey deposits they also occur with stratified clays. These soils occur in depressional positions of nearly level slopes on level landscapes and have very slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Osborne soils are non-eroded, non-stony, and often slightly saline. They have a high available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes reeds, meadow grasses, sedges and willows. The majority of these soils are currently cultivated where drainage is improved.

In a representative profile of Osborne soil the solum is approximately 15 cm thick. The profile is characterized by a very dark gray to dark gray Ah horizon, 5 to 10 cm thick, and a olive gray to dark gray Ck horizon, with distinct to prominent mottles. A typical profile also contains a peaty surface layer.

Osborne soils occur in close association with Winkler, Deadhorse and Plum Coulee soils. They are similar to Kerran soils by having a poorly drained clayey profile but differ from them in having lacustrine rather than alluvial deposits. Osborne soils were previously mapped as Meadow associates of the Red River Association in the Carberry (1957) soil report.

Osterwick Series (OWK)

The Osterwick series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS,LVFS,FSL,L,VFSL) deposits. These soils occur in depressional positions of nearly level slopes on level landscapes and have moderately rapid permeability, very slow surface runoff, and a high to ponded water table during the growing season. Osterwick soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes meadow grasses, sedges, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Osterwick soil the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed Om horizon, 6 to 12 cm thick, a very dark gray Ah horizon, 15 to 25 cm thick a light gray AC horizon, 5 to 10 cm thick and a gray Ck horizon with yellowish brown mottles. A typical profile also contains a Cca horizon below the AC horizon.

Osterwick soils occur in close association with Kronstal, Reinland and Hochfeld soils. They are similar to Lelant soils by having a poorly drained profile in sand textured deposits but differ from them in having dominantly VFS rather than FS textures. Osterwick soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Pembina Series (PBI)

The Pembina series consists of moderately well to well drained Dark Gray Luvisol soil developed on moderately to very strongly calcareous, deep, uniform, loamy, mixed till deposits. These soils occur in middle to upper positions of moderate to strong slopes on hummocky landscape and have moderate permeability rapid surface runoff and a low water table during the growing season. Pembina soils are moderately to severely eroded in upper slope positions, slightly stony and non-saline. They have high available water holding capacity, moderate organic matter content and moderate natural fertility.

In a representative profile of Pembina soil the solum is approximately 50 cm thick. The profile is characterized by a dark grayish brown Ah or Ap horizon, 15 to 20 cm thick, a light gray Ae horizon, 5 to 8 cm thick with platy structure, a brown to pale brown, clay loam to silty clay textured Bt horizon 15 to 30 cm thick and a white Cca horizon of lime accumulation.

Pembina soils occur in close association with Dezwood, Vandal and Firdale soils. They are similar to Poyser soils by having a luvisolic profile developed in mixed till but differ from them because of an Ah or Ahe horizon more than 5 cm thick in undisturbed profiles. Pembina soils were previously mapped as the well drained, dominant associates of the Pembina association in the reconnaissance soil survey of South-Central Manitoba (1943).

An example profile of a Pembina soil is presented in Appendix F.

Pembina Series coarse-loamy substrate variant (PBI1)

The Pembina series coarse-loamy (L, SIL, VFSL) substrate variant, occurs in close association with typical Pembina soils and differs from them in having light yellowish brown, relatively stone-free, coarse-loamy substrate material within a meter of the soil surface.

Pembina Series, sandy-skeletal substrate variant (PBI2)

The Pembina series, sandy-skeletal (LCS, GrS, LGrS), substrate variant, occurs in close association with Pembina soils and differs from them in having sandy-skeletal substrate material of glacio-fluvial origin within a meter of the mineral surface.

Perillo Series (PER)

The Perillo series consists of very poorly drained Terric Mesisol soil developed on a mantle (40 to 160 cm) of moderately decomposed organic, material composed of fen peat over moderately to strongly calcareous, deep, uniform, coarse loamy (L, SiL, VFSL), lacustrine deposits. These soils occur in depressional positions of nearly level slopes on rolling to hummocky landscapes and have slow permeability very slow surface runoff and a very high water table during the growing season. Perillo soils are occasionally slightly saline. They have a high available water holding capacity, very high organic matter content, and low natural fertility. Native vegetation often includes sedges, reeds, and clumps of willow or swamp birch. The majority of these soils are currently used for natural grazing.

In a representative profile of Perillo soil the solum is approximately 50 cm thick. The profile is characterized by a black Om horizon, 5 to 15 cm thick, a black Oh horizon, 20 to 45 cm thick, a black Ah horizon, 15 to 25 cm thick, with a few large iron mottles and a light brownish gray AC horizon 10 to 25 cm thick, with many large prominent iron mottles. The mineral soil parent material is typically light gray in color with numerous prominent mottles and manganese concretions. A typical profile also contains snail shells on the surface and throughout the profile.

Perillo soils occur in association with sloughs, lakes and areas of restricted drainage. They are similar to Tadpole peaty phase soils but differ from them in having an organic surface horizon greater than 40 cm thick to the mineral soil substrate. Perillo soils were previously mapped as meadow or marsh inclusions of many soil associates in the reconnaissance soil survey of South-Central Manitoba (1943).

Perillo Series, Fine loamy substrate variant (PER1)

The Perillo series, fine loamy (SiCL,CL,SiC) substrate variant, occurs in close association with typical Perillo soils and differs from them in having fine loamy substrate material.

Pleasant Series (PLE)

The Pleasant series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS,LVS,FSL), lacustrine and fluvial deposits. These soils occur in middle positions of gentle slopes on irregular to undulating landscapes and have moderate permeability, moderately slow surface runoff, and a high water table during the growing season. Pleasant soils are non-eroded, non-stony, and frequently slightly saline. They have a medium available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, prairie-meadow grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Pleasant soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 25 cm thick, a dark grayish brown AC horizon, 6 to 10 cm thick, a Cca horizon, 10 to 15 cm thick and a light olive brown Ck horizon, with yellowish brown mottles. A typical profile also contains gypsum crystals below the Cca horizon.

Pleasant soils occur in close asociation with Prosser, Gateside and Poolex soils. They are similar to Taggart soils by having an imperfectly drained Gleyed Rego Black profile but differ from them in having coarse loamy rather than loamy deposits. Pleasant soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Plum Coulee Series (PME)

The Plum Coulee series consists of imperfectly drained Gleyed Black soil developed on moderately calcareous, stratified, deep, clayey (SiC,C), fluvial and lacustrine deposits. These soils occur in middle positions of nearly level slopes on level landscapes and have slow permeability, moderately slow surface runoff, and a high water table during the growing season. Plum Coulee soils are non-eroded, non-stony, and occasionally slightly saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie-meadow and tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Plum Coulee soil the solum is approximately 50 cm thick. The profile is characterized by very dark gray Ah horizon, 13 to 25 cm thick, with firm to friable consistence, a dark grayish brown Bm horizon, 15 to 30 cm thick with compound weak, medium prismatic and moderate medium granular structure, and a stratified clay textured C horizon, with gypsum crystals. A typical profile also contains faint mottles in the C and lower B horizons.

Plum Coulee soils occur in close association with Winkler and Deadhorse soils. They are similar to Deadhorse soils by having an imperfectly drained profile in stratified clayey deposits but differ from them in having a diagnostic Bm horizon. Plum Coulee soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Poolex Series (POX)

The Poolex series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, deep, uniform, coarse loamy (VFS,LVFS,FSL,SL), lacustrine and fluvial deposits. These soils occur in level to depressional positions of nearly level slopes on undulating landscapes and have moderate permeability, slow surface runoff, and a high to ponded water table during the growing season. Poolex soils are non-eroded, nonstony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, seeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Poolex soil the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, 1 to 4 cm thick, a very dark gray Ah horizon, 15 to 22 cm thick, a olive gray to gray AC horizon, 6 to 12 cm thick with moderate calcareousness and a Cca horizon, 10 to 15 cm thick. The parent material is typically olive brown to pale olive with yellowish brown mottles.

Poolex soils occur in close association with Porple, Pleasant and Gateside soils. They are similar to Vordas soils by having a poorly drained profile in loamy deposits but differ from them in having slightly coarser textures. Poolex soils were previously mapped as Meadow associates of the Poolex Association in the Carberry (1957) soil report.

Poplar Point Series (PPR)

The Poplar Point series consists of imperfectly drained Gleyed Cumulic Regosol soil developed on weakly to moderately calcareous, deep, stratified loamy (SiL,L,SiCL,CL), recent fluvial deposits. These soils occur in middle positions of very gentle slopes on flood prone terrace, levee and meander landscapes and have moderate permeability, slow surface runoff, and a high water table during the growing season. Poplar Point soils are slightly water eroded, nonstony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes deciduous trees and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Poplar Point soil the solum is not developed. The profile is characterized by a very weak Ah or Ap horizon, 10 to 20 cm thick, and a slightly lighter Ck horizon with distinct iron mottles.

Poplar Point soils occur in close association with Elm River and Willowbend soils. They are similar to Gervais soils by having Gleyed Cumulic Regosol soil in loamy alluvium but differ from them in having no distinct A horizon. Poplar Point soils were previously mapped as inclusions of the Assiniboine Complex in the Carberry (1957) soil report.

Prodan Series (PDA)

The Prodan series consists of imperfectly drained Gleyed Rego Black soil developed on strongly to very strongly calcareous, deep, uniform, fine loamy (CL,SiCL), lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate to moderately slow permeability, moderately slow surface runoff, and a high water table during the growing season. Prodan soils are non-eroded, non-stony, and frequently slightly saline. They have a high available water holding capacity, high organic matter content, and high natural fertility. Native vegetation includes prairie-meadow grasses, tall prairie grasses and mixed shrubs. The majority of these soils are currently cultivated for grain crop production. In a representative profile of Prodan soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a dark gray to gray AC horizon, 8 to 15 cm thick with moderate calcareousness, a Cca horizon, 5 to 8 cm thick and a light brownish gray Ck horizon, with yellowish brown mottles.

Prodan soils occur in close association with Ramada, Charman and Tadpole soils. They are similar to Charman soils by having imperfect drainage and loamy deposits but differ from them in having no prominent Bm horizon. Prodan soils were previously mapped as Black Meadow associates of the Holland Association in the Carberry (1957) soil report.

Petrel Series (PTR)

The Petrel series consists of imperfectly drained Gleyed Black soil developed on a mantle (25 to 75 cm) of moderately to strongly calcareous, shallow, loamy (VFSL,L,SiL), deposits over moderately calcareous, uniform, deep, sandy (FS,LFS,LS), lacustrine and fluvial deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, moderately slow surface runoff, and a high water table during the growing season. Petrel soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, shrubs, aspen and oak. The majority of these soils are currently cultivated for crop production.

In a representative profile of Petrel soil the solum is approximately 40 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a brown Bm horizon, 14 to 20 cm thick, a BC horizon, 20 to 30 cm thick with faint mottles and a light yellowish brown Ck horizon, with yellowish brown to strong brown mottles. A typical profile also contains a weak Cca in the upper part of the sandy substrate.

Petrel soils occur in close association with Glenboro, Grover and Grayson soils. They are similar to Torcan soils by having imperfect drainage and a loamy surface but differ from them in having a sandy substrate. Petrel soils were previously mapped as Black Meadow associates of the Glenboro Association in the Carberry (1957) soil report.

Rathwell Series (RWL)

The Rathwell series consists of imperfectly drained Gleyed Black soil developed on strongly calcareous, deep, uniform, fine loamy (CL,SiCL), lacustrine deposits. These soils occur in middle positions of very gentle slopes on level to undulating landscapes and have moderate to moderately slow permeability, moderate surface runoff, and a high water table during the growing season. Rathwell soils are non-eroded, non-stony, and often slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, prairie-meadow grasses, deciduous trees and shrubs. The majority of these soils are currently cultivated for grain crop production. In a representative profile of Rathwell soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray to black Ap or Ah horizon, 20 to 30 cm thick, a brown Bm horizon, 15 to 20 cm thick with distinct mottles, a transitional BC horizon, 8 to 12 cm thick and a Ck horizon, with many distinct mottles.

Rathwell soils occur in close association with Eigenhof and Neuhorst soils. They are similar to Rignold soils by having imperfect drainage and loamy surface deposits but differ from them in having no clayey substrate. Rathwell soils were previously mapped as associates of the Rathwell Association in the Carberry (1957) soil report.

Ramada Series (RAM)

The Ramada series consists of well to moderately well drained orthic Black soil developed on strongly to very strongly calcareous, deep, uniform, fine loamy (CL,SiCL), lacustrine deposits. These soils occur in middle and upper positions of very gentle slopes on undulating landscapes and have moderate to moderately slow permeability, moderately rapid surface runoff, and a low water table during the growing season. Ramada soils are occasionally slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes prairie grasses, aspen, oak and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Ramada soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray Ap horizon, 10 to 20 cm thick, a dark grayish brown to brown Bm horizon, 8 to 12 cm thick, a BC horizon, 6 to 10 cm thick with weak calcareousness and a pale brown to light yellowish brown Ck horizon.

Ramada soils occur in close association with Carroll, Charman and Prodan soils. They are similar to Carroll soils by having a well drained Black profile in fine loamy deposits but differ from them in having a prominent Bm horizon. Ramada soils were previously mapped as Blackearth associates of the Holland Association in the Carberry (1957) soil report.

Reinfeld Series (RFD)

The Reinfeld series consists of moderately well to well drained Orthic Black soil developed on moderately to strongly calcareous, stratified, deep, loamy (VFSL,L,SiL), fluvial and lacustrine deposits. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderate permeability, moderate surface runoff, and a low water table during the growing season. Reinfeld soils are non-eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Reinfeld soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 40 cm thick, a brown Bm horizon, 15 to 25 cm thick, and a pale brown Ck horizon, with occasional faint mottles.

Reinfeld soils occur in close association with Gnadenthal and Blumenfeld soils. They are similar to Rosengart soils by having a well drained Black profile and a loamy surface but differ from them in having no coarse loamy substrate. Reinfeld soils were previously mapped as Blackearth associates of the Rathwell Association in the Carberry (1957) soil report.

Reinland Series (RLD)

The Reinland series consists of imperfectly drained Gleyed Rego Black soil developed on moderately to strongly calcareous, stratified, deep, coarse loamy (LVFS,VFS,FSL,SL), fluvial and lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderate to moderately rapid permeability, moderate surface runoff, and a high water table during the growing season. Reinland soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses and deciduous tree clumps. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Reinland soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 30 cm thick, with weak calcareousness, a dark gray to grayish brown AC horizon, 8 to 20 cm thick, a light gray Cca horizon, 8 to 10 cm thick and a pale brown to light gray Ck horizon, with faint mottles.

Reinland soils occur in close association with Hochfeld, Kronstal and Osterwick soils. They are similar to Rosebank soils by having imperfect drainage and a coarse loamy surface but differ from them in having no clayey substrate. Reinland soils were previously mapped as associates of the Almasippi Association in the Carberry (1957) soil report.

Rempel Series (RMP)

The Rempel series consists of moderately well to well drained Calcareous Black soil developed on strongly to very strongly calcareous, deep, uniform, fine loamy (CL,SiCL), lacustrine deposits. These soils occur in upper positions of gentle slopes on undulating landscapes and have moderate permeability, moderately rapid surface runoff, and a low water table during the growing season. Rempel soils are occasionally slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, meadow grasses and aspen-oak groves. The majority of these soils are currently cultivated for crop production.

In a representative profile of Rempel soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray to very dark grayish brown Ah horizon, 15 to 22 cm thick, with weak calcareousness, a dark grayish brown to brown Bmk horizon, 10 to 15 cm thick, a pale brown BC horizon, 5 to 10 cm thick with moderate calcareous and a light gray to white Cca horizon, 10 to 15 cm thick with lime accumulation. A typical profile also contains a pale brown Ck horizon.

Rempel soils occur in close association with Ramada, Prodan and Tadpole soils. They are similar to Ramada soils by having well drained, fine loamy soils but differ from them in having a Bmk rather than Bm horizon. Rempel soils were previously mapped as Blackearth associate of the Holland Association in the Carberry (1957) soil report.

Rignold Series (RGD)

The Rignold series consists of imperfectly drained Gleyed Black soil developed on a mantle (60 to 90 cm) of moderately calcareous, shallow, uniform, loamy (VFSL,L,SiL,SCL,CL,SiCL), fluvial and lacustrine deposits over moderately calcareous, deep, uniform, clayey (SiC,C), lacustrine deposits. These soils occur in middle positions of nearly level slopes on level landscapes and have moderate over slow to very slow permeability, slow surface runoff, and a high water table during the growing season. Rignold soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, meadow grasses and shrubs. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Rignold soil the solum is approximately 50 cm thick. The profile is characterized by a very dark gray Ah horizon, 18 to 25 cm thick, a light brown Bm horizon, 20 to 30 cm thick a transitional BC horizon, 10 to 15 cm thick with faint mottles and a light olive brown Ck horizon with fine yellowish brown mottles. The parent material is typically slightly saline.

Rignold soils occur in close association with Denham, Graysville and Edkins soils. They are similar to Graysville soils by having imperfect drainage and loamy over clayey deposits but differ from them in having a prominent Bm horizon. Rignold soils were previously mapped as Black Meadow associates of the Rathwell Association in the Carberry (1957) soil report.

Rosengart Series (RSG)

The Rosengart series consists of moderately well drained Orthic Black soil developed on a mantle (70 to 95 cm) of moderately to strongly calcareous, shallow, uniform, loamy (VFSL,L,SiL), deposits over moderately calcareous, stratified, deep, sandy (LFS,FS,VFS,LVFS), lacustrine deposits. These soils occur in upper positions of very gentle slopes on undulating landscapes and have moderate over moderately rapid permeability, moderate to moderately rapid surface runoff, and a medium water table during the growing season. Rosengart soils are non-eroded, non-stony, and non-saline. They have medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes tall prairie grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for crop production.

In a representative profile of Rosengart soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 35 cm thick, a dark grayish brown Bm horizon, 15 to 25 cm thick a BC horizon, 10 to 18 cm thick and a pale brown Ck horizon with faint to distinct mottles.

Rosengart soils occur in close association with Jasset and Neuenberg soils. They are similar to Reinfeld soils by having an Orthic Black profile and loamy surface but differ from them in having a sandy substrate. Rosengart soils were previously mapped as Blackearth associates of the Almasippi Association in the Carberry (1957) soil report.

Rosebank Series (RBK)

The Rosebank series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 95 cm) of moderately calcareous, shallow, uniform, coarse loamy (LVFS,VFS,FSL), lacustrine deposits over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine deposits. These soils occur in middle positions of nearly level to very gentle slopes on undulating landscapes and have moderate over slow to very slow permeability, slow surface runoff, and a high water table during the growing season. Rosebank soils are non-eroded, non-stony, and often slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes prairie grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Rosebank soil the solum is approximately 30 cm thick. The profile is characterized by a very dark gray to black Ah horizon, 15 to 32 cm thick, with weak granular structure, a dark gray to grayish brown AC horizon, 10 to 15 cm thick with granular structure, and friable to loose consistence, and a pale brown friable to loose Ck with faint mottles. Calcium carbonate concretions and many fine to medium mottles often occur at the clay contact. The parent material is typically mildly alkaline. A typical profile is often weakly to moderately calcareous throughout.

Rosebank soils occur in close association with Hibsin, Elm Creek and Layland soils. They are similar to Reinland soils by having a coarse loamy imperfectly drained profile but differ from them in having a clayey substrate. Rosebank soils were previously mapped as associates of the Almasippi clay substrate Association in the Carberry (1957) soil report.

St. Claude Series (SUE)

The St. Claude series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (50 to 75 cm) of strongly to very strongly calcareous, shallow, loamy (SCL,L,SiL), lacustrine deposits over moderately calcareous, uniform, shallow, sandy (FS,LFS), lacustrine deposits. These soils occur in middle to lower positions of very gentle to gentle slopes on hummocky landscapes and have moderately slow to slow over rapid permeability, slow surface runoff, and a high water table during the growing season. St. Claude soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes aspen, black poplar, willow and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of St. Claude soil the solum is approximately 15 cm thick. The profile is characterized by a dark gray, strongly calcareous Ah horizon, 13 to 20 cm thick, a strongly to extremely calcareous Cca or AC horizon, 13 to 25 cm thick with prominent mottles, and a light yellowish brown to olive gray, moderately calcareous C horizon with many prominent mottles. The parent material is typically finer textured at 1.5 to 5 meters depth. A typical profile also contains silt and clay sized carbonates and little clay in the loamy sediments.

St. Claude soils occur in close association with Rosengart, Neuenberg and Jasset soils. They are similar to Almasippi soils by having imperfect drainage and a sandy substrate but differ from them in having a loamy, prominent Cca or AC horizon. St. Claude soils were previously mapped as inclusions of the Almasippi Association in the Carberry (1957) soil report.

Sewell Series (SEE)

The Sewell series consists of poorly drained Rego Humic Gleysol soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFs,LS), lacustrine and fluvial deposits. These soils occur in depressional positions of gentle slopes on hummocky landscapes and have moderately rapid permeability, very slow surface runoff, and a high to ponded water table during the growing season. Sewell soils are non-eroded, non-stony, and often slightly saline. They have a low available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Sewell soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray to gray AC horizon, 10 to 15 cm thick with carbonates and mottles, and usually a Cca horizon, 5 to 8 cm thick. A typical profile also contains an olive to pale olive Ck horizon with yellowish brown mottles and manganese concretions.

Sewell soils occur in close association with Stockton, Lavenham and Hummerston soils. They are similar to Osterwick soils by having poor drainage and a Rego Humic Gleysol profile but differ from them in having sandy rather than coarse loamy deposits. Sewell soils were previously mapped as Meadow associates of the Stockton Association in the Carberry (1957) soil report.

Shellmouth Complex (SHU)

The Shellmouth Complex consists of well to excessively drained Orthic Regosol soil developed on variable textured deposits. These soils occur in crest to lower positions of very strong to extreme slopes on river and streambank landscapes and have variable permeability, rapid surface runoff, and a low water table during the growing season. Shellmouth soils are actively severely eroded, non-stony, and non-saline. They have variable available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes forests of aspen, oak and willow. The majority of these soils are currently too steep to be cultivated. In a representative profile of Shellmouth soil the solum is not developed. The profile is characterized by a very thin LF horizon, 1 to 3 cm thick, with leaf litter and a Ck horizon.

Shellmouth soils occur in close association with alluvial soils along stream banks. Shellmouth soils were previously mapped as Eroded Slopes (ERX) in the Carberry (1957) soil report.

Shilox Series (SHX)

The Shilox series consists of moderately well to excessively drained Orthic Regosol soil developed on weakly to noncalcareous, deep, uniform, sandy (FS,LS,S), eolian deposits. These soils occur in middle and upper positions of moderate to strong slopes on hummocky to duned landscapes and have rapid to very rapid permeability, very slow surface runoff, and a low water table during the growing season. Shilox soils are severely wind eroded, non-stony, and non-saline. They have low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes oak, black spruce, juniper and prairie grasses. The majority of these soils are currently wooded.

In a representative profile of Shilox soil the solum is not developed. The profile is characterized by a partially decomposed LH horizon, 1 to 2 cm thick, a grayish brown to pale brown Ah horizon, 6 to 10 cm thick, and a light yellowish brown to pale brown C horizon. A typical profile also contains an occasional buried Ah horizon, 2 to 4 cm thick.

Shilox soils occur in close association with Onahan and Mockry soils. They are similar to Arizona soils by having a Regosol profile in sandy deposits but differ from them in having less stratification and more uniform textures. Shilox soils were previously mapped as associates of the Stockton Association in the Carberry (1957) soil report.

Skelding Series (SKL)

The Skelding series consists of excessively drained Orthic Regosol soil developed on weakly calcareous, deep, uniform, sandy (FS,LFS), recent eolian deposits. These soils occur in upper positions of gentle slopes on duned landscapes and have rapid to very rapid permeability, very slow surface runoff, and a low water table during the growing season. Skelding soils are actively severely wind eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and low natural fertility. Native vegetation includes aspen juniper, oak and short prairie grasses. The majority of these soils are currently stabilized by being seeded to grasses.

In a representative profile of Skelding soil the solum is not developed. The profile is characterized by a dark yellowish brown Ah horizon, 5 to 10 cm thick, and a dark yellowish brown C horizon. A typical profile extends to more than a meter before carbonates occur.

Skelding soils occur in close association with Long Plain, Almasippi and Lelant soils. They are similar to Shilox soils by having sandy eolian deposits and a Regosol profile but differ from them by occurring in a slightly warmer climate. Skelding soils were previously mapped as inclusions of the Almasippi Association in the Carberry (1957) soil report.

Squirrel Creek Series (SQR)

The Squirrel Creek series consists of imperfectly drained Gleyed Rego Black soil developed on a mantle (60 to 90 cm) of strongly to very strongly calcareous, shallow, loamy (FSL,L,SiL,SCL), lacustrine deposits over moderately calcareous, uniform, deep, clayey (SiC,C), lacustrine deposits. These soils occur in middle positions of gentle to very gentle slopes on undulating landscapes and have moderately slow over slow permeability, slow surface runoff, and a high water table during the growing season. Squirrel Creek soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, willow, poplar and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Squirrel Creek soil the solum is approximately 15 cm thick. The profile is characterized by a dark gray Ah horizon, 13 to 20 cm thick, with strong calcareousness, an AC or Cca horizon, 13 to 25 cm thick with strong to extreme calcareousness, and a moderately calcareous IICk horizon, with prominent iron mottles. A typical profile also contains sandy strata above the clay substrate.

Squirrel Creek soils occur in close association with Denham, Rignold and Edkins soils. They are similar to St. Claude soils by having a prominent Cca horizon and imperfect drainage but differ from them in having a clayey substrate. Squirrel Creek soils were previously mapped as minor inclusions of the Rathwell Association in the Carberry (1957) soil report.

Stockton Series (SCK)

The Stockton series consists of moderately well to well drained Orthic Black soil developed on weakly to moderately calcareous, deep, uniform, sandy (FS,LFS,LS), lacustrine deposits. These soils occur in upper positions of gentle to very gentle slopes on irregular undulating landscapes and have rapid permeability, moderate surface runoff, and a low water table during the growing season. Stockton soils are often slightly wind eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, black spruce and prairie grasses. The majority of these soils are currently cultivated for grain and forage crops.

In a representative profile of Stockton soil the solum is approximately 40 cm thick. The profile is characterized by very dark gray to very dark grayish brown Ah horizon, 18 to 25 cm thick, a brown to grayish brown Bm horizon, 12 to 22 cm thick, a pale brown to light yellowish brown BC horizon, 8 to 12 cm thick, and a very pale brown Ck horizon, with a few yellowish brown mottles. A typical profile also contains a thin Cca horizon below the BC horizon.

Stockton soils occur in close association with Lavenham, Cactus and Sewell soils. They are similar to Cactus soils by having a well drained sandy profile but differ from them in having a prominent Bm horizon. Stockton soils were previously mapped as Blackearth associates of the Stockton Association in the Carberry (1957) soil report.

Tadpole Series (TDP)

The Tadpole series consists of poorly drained Rego Humic Gleysol soil developed on strongly to very strongly calcareous, deep, uniform, fine loamy (CL,SiCL), lacustrine deposits. These soils occur in depressional positions of nearly level slopes on undulating landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Tadpole soils are non-eroded, non-stony, and frequently moderately saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, reeds, rushes and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Tadpole soil the solum is approximately 20 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 6 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray AC horizon, 4 to 6 cm thick with moderate calcareousness and an olive to olive gray Ck horizon, with distinct yellowish brown mottles.

Tadpole soils occur in close association with Carroll, Firdale and Charman soils. They are similar to Vordas soils by having poor drainage and lacustrine deposits but differ from them in having fine loamy rather than loamy materials. Tadpole soils were previously mapped as Meadow associates of the Holland Association in the Carberry (1957) soil report.

Taggart Series (TGR)

The Taggart series consists of imperfectly drained Gleyed Rego Black soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,L,SiL), lacustrine deposits. These soils occur in middle positions of gentle to very gentle slopes on undulating landscapes and have moderate permeability, slow surface runoff, and a high water table during the growing season. Taggart soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, oak, willow and prairie grasses. The majority of these soils are currently cultivated for crop production.

In a representative profile of Taggart soil the solum is approximately 20 cm thick. The profile is characterized by a very dark gray Ah horizon, 15 to 24 cm thick, a dark gray AC horizon, 5 to 15 cm thick with moderate calcareousness, a Cca horizon, 8 to 12 cm thick with lime carbonates and an olive brown Ck horizon, with yellowish brown mottles. A typical profile also contains gypsum crystals below the Cca horizon.

Taggart soils occur in close association with Fairland, Durnan and Vordas soils. They are similar to Torcan soils by having imperfect drainage and loamy deposits but differ from them in having no prominent Bm horizon. Taggart soils were previously mapped as associates of the Holland Association in the Carberry (1957) soil report.

Tellier Series (TLI)

The Tellier series consists of imperfectly drained Gleyed Dark Gray soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, uniform, fine loamy (L, CL, SICL), lacustrine deposits over moderately to strongly calcareous, deep, uniform fine loamy (CL, L, SICL) mixed till deposits. These soils occur in lower slope positions of very gentle slopes on undulating landscapes and have moderate permeability moderate surface runoff and a medium water table during the growing season. Tellier soils have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Tellier soil the solum is approximately 45 cm thick. The profile is characterized by dark gray Ap or Ah horizon, 10 to 20 cm thick, a very dark brown Bt or Btj horizon, 20 to 30 cm thick with a few fine faint iron mottles, a grayish brown, carbonated, transitional IIBC horizon, 10 to 15 cm thick and a dark yellowish brown IICk horizon with common, distinct, fine iron mottles.

Tellier soils occur in close association with Altamont and Narish soils. They are similar to Zaplin soils by having a Gleyed Dark Gray profile and a fine loamy till substrate but differ from them in not having a lacustrine mantle over the till substrate. Tellier soils were previously mapped as minor imperfectly drained associates of the Altamont association in the reconnaissance soil survey of South-Central Manitoba (1943).

Traverse Series (TAV)

The Traverse series consists of well to moderately well drained Calcareous Black soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,L,SiL), lacustrine deposits. These soils occur in middle and upper positions of very gentle slopes on rolling to undulating landscapes and have moderate permeability, moderate to rapid surface runoff, and a low water table during the growing season. Traverse soils are often slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes oak, aspen, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Traverse soil the solum is approximately 25 cm thick. The profile is characterized by a very dark gray Ah horizon, 10 to 18 cm thick, a dark grayish brown Bmk horizon, 8 to 15 cm thick with moderate calcareousness, a brown to pale brown BC horizon, 10 to 15 cm thick with moderate calcareousness and a white Cca horizon, 8 to 12 cm thick with lime accumulation. The parent material is typically dark yellowish brown.

Traverse soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Rempel soils by having a Calcareous Black profile but differ from them in having loamy rather than fine loamy deposits. Traverse soils were previously mapped as Calcareous Black associates of the Holland Association in the Carberry (1957) soil report.

Torcan Series (TOC)

The Torcan series consists of imperfectly drained Gleyed Black soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,L,SiL), lacustrine deposits. These soils occur in middle to lower positions of very gentle slopes on rolling to undulating landscapes and have moderate permeability, moderately slow surface runoff, and a medium water table during the growing season. Torcan soils are non-eroded, non-stony, and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, willow, shrubs and meadow grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Torcan soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray Ah horizon 18 to 25 cm thick, a light brown Bm horizon, 10 to 18 cm thick with yellowish brown mottles, a Cca horizon, 8 to 12 cm thick, and a light olive brown Ck horizon, with yellowish brown mottles.

Torcan soils occur in close association with Fairland, Taggart and Vordas soils. They are similar to Taggart soils by having imperfect drainage and loamy deposits but differ from them in having a prominent Bm horizon. Torcan soils were previously mapped as associates of the Holland Association in the Carberry (1957) soil report.

Trinton Series (TNT)

The Trinton series consists of well to moderately well drained Dark Gray Luvisol soil developed on a mantle (25 to 90 cm) of moderately to strongly calcareous, shallow, loamy (VFS,LVFS,FSL,VFSL,L,SiL), lacustrine deposits over moderately to strongly calcareous, deep, stratified, sandy-skeletal (S,LS,GrLS,GrCS), glaciofluvial deposits. These soils occur in middle and upper positions of gentle slopes on hummocky to undulating landscapes and have moderate over rapid permeability, moderate to rapid surface runoff, and a low water table during the growing season. Trinton soils are occasionally slightly eroded, non-stony, and non-saline. They have a low available water holding capacity, low organic matter content, and medium to low natural fertility. Native vegetation includes aspen, oak, ash and prairie grasses. The majority of these soils are currently cultivated for grain and forage crops.

In a representative profile of Trinton soil the solum is approximately 45 cm thick. The profile is characterized by a moderately decomposed leaf litter horizon, 4 to 7 cm thick, a dark gray Ahe horizon, 5 to 10 cm thick, a gray to light gray Ae horizon, 7 to 12 cm thick, a brown Bt horizon, 15 to 25 cm thick and a BC horizon 5 to 10 cm thick. A typical profile extends to the sandy skeletal substrate.

Trinton soils occur in close association with Vandal, Vartel and Carvey soils. They are similar to Vandal soils by having a well drained profile in loamy over sandy-skeletal deposits but differ from them in having a prominent Ahe or Ae horizon. Trinton soils were previously mapped as minor associates of the Leary Association in the South-Central (1943) soil report.

Trinton Series, shale gravel substrate variant (TNT1)

The Trinton series shale gravel substrate, variant, occurs in close association with Trinton soils and differs from them in having dominantly shale derived coarse fragments in the sandy-skeletal substrate.

Vandal Series (VDL)

The Vandal series consists of well drained Orthic Dark Gray soil developed on a mantle (30 to 100 cm) of moderately to strongly calcareous, thin stratified, loamy (SiL, L, SL), lacustrine deposits over moderately to strongly calcareous, deep, stratified, sandy skeletal (GrS, LGrS) glaciofluvial deposits. These soils occur in middle and upper positions of very gentle to moderate slopes on hummocky landscapes and have moderate over rapid permeability moderate surface runoff and a low water table during the growing season. Vandal soils have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie grasses aspen popular and scrub oak. The majority of these soils are currently used for mixed farming but where gravel deposits are sufficiently deep they have been mined as a source for gravel.

In a representative profile of Vandal soil the solum is approximately 45 cm thick. The profile is characterized by a very dark grayish brown Ap or Ah horizon, 10 to 18 cm thick, a grayish brown Bt or Btj horizon, 20 to 35 cm thick, a yellowish brown IICca horizon, 10 to 20 cm thick with numerous coarse fragments and a brown to light brown IICk horizon with mixed shale, limestone and granite gravel. The parent material is typically stratified with very gravelly and coarse sand layers (8 to 10 cm). A typical profile also contains thin (<2 cm) lenses of silt loam to very fine sandy loam at depth.

Vandal soils occur in close association with Trinton, Vartel and Carvey soils. They are similar to Altamont soils by having an Orthic Dark Gray profile developed mostly in loamy and fine silty deposits but differ from them in having a sandy and gravelly substrate rather than a fine loamy glacial till substrate. Vandal soils were previously mapped as a dominant associate of the Leary Association in the reconnaissance soil survey of South-Central Manitoba (1943).

Vandal Series, shale gravel substrate variant (VDL1)

The Vandal series shale gravel substrate variant, occurs in close association with Vandal soils and differ from them in having dominantly shale derived coarse fragments in the sandy-skeletal substrate.

Vartel Series (VTL)

The Vartel series consists of imperfectly drained Gleyed Dark Gray soil developed on a mantle (25 to 100 cm) of moderately to strongly calcareous, stratified, loamy (SIL, L, SL), lacustrine deposits over moderately to strongly calcareous, stratified, deep sandy-skeletal (GrS, LGrS), glaciofluvial deposits. These soils occur in lower slope positions of very gentle to moderate slopes on hummocky landscapes and have moderate over rapid permeability, moderately slow surface runoff and a medium water table during the growing season. Vartel soils are non-eroded, non-stony and occasionally slightly saline. They have medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Vartel soil the solum is approximately 50 cm thick. The profile is characterized by a dark gray Ap or Ah horizon, 10 to 20 cm thick, a brown to olive brown Bt or Btj horizon, 15 to 30 cm thick with many, fine, faint iron mottles, an olive brown IIBC horizon, 5 to 15 cm thick with faint iron mottles and a dark yellowish brown IICk horizon with large, distinct iron mottles. The parent material is typically mixed gravel of limestone, granite and shale origin. A typical profile also contains thin strata of L, VFSL and SiL interspersed with gravelly layers.

Vartel soils occur in close association with Vandal and Carvey soils. They are similar to Tellier soils by having a Gleyed Dark Gray profile developed in fine loamy lacustrine deposits but differ from them in having a sandy-skeletal glaciofluvial substrate rather than a fine loamy glacial till substrate. Vartel soils were previously mapped as imperfectly drained associates of the Leary association and Indian Springs complex in the reconnaissance soil survey of South-Central Manitoba (1943).

Vartel Series, shale gravel substrate variant (VTL1)

The Vartel series shale gravel substrate variant, occurs in close association with typical Vartel soils and differs in having dominantly shale derived coarse fragments in the sandy-skeletal substrate.

Vordas Series (VDS)

The Vordas series consists of poorly drained Rego Humic Gleysol soil developed on strongly to very strongly calcareous, deep, uniform, loamy (VFSL,SiL,L), lacustrine deposits. These soils occur in level to depressional positions of very gentle slopes on undulating landscapes and have moderate permeability, very slow surface runoff, and a high to ponded water table during the growing season. Vordas soils are non-eroded, non-stony, and often slightly saline. They have a medium available water holding capacity, high organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Vordas soil the solum is approximately 15 cm thick. The profile is characterized by a moderately decomposed organic horizon, 2 to 5 cm thick, a very dark gray Ah horizon, 10 to 18 cm thick, a dark gray AC horizon, 4 to 6 cm thick with carbonates and mottles, and an olive to pale olive Ck horizon, with yellowish brown iron mottles. A typical profile also contains white pseudomycelia of salt in the Ah and AC horizons in saline areas.

Vordas soils occur in close association with Fairland, Taggart and Torcan soils. They are similar to Tadpole soils by having poor drainage and loamy deposits but differ from them in having slightly coarser textures. Vordas soils were previously mapped as Meadow associates of the Holland Association in the Carberry (1957) soil report.

Wellwood Series (WWD)

The Wellwood series consists of well to moderately well drained Orthic Black soil developed on a mantle (25 to 75 cm) of strongly calcareous, shallow, uniform, fine loamy (CL,SiCL), lacustrine deposits over moderately calcareous, deep, uniform, sandy (FS,LFS,LS), glaciofluvial deposits. These soils occur in upper positions of gentle to very gentles slopes on undulating to hummocky landscapes and have moderate over rapid permeability, moderate to moderately slow surface runoff, and a low water table during the growing season. Wellwood soils are occasionally slightly eroded, non-stony, and non-saline. They have a medium available water holding capacity, medium organic matter content, and high natural fertility. Native vegetation includes aspen, oak, shrubs and prairie grasses. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Wellwood soil the solum is approximately 45 cm thick. The profile is characterized by a black to very dark gray Ah horizon, 18 to 30 cm thick, a dark brown to brown Bm horizon, 16 to 24 cm thick with prismatic to subangular blocky structure, a yellowish brown to pale brown BC horizon, 8 to 14 cm thick, and a Cca horizon, 7 to 10 cm thick with lime accumulation.

Wellwood soils occur in close association with Crookdale and Sutton soils. They are similar to Glenboro soils by having an Orthic Black profile and sandy substrate but differ from them in having a fine loamy rather than loamy surface. Wellwood soils were previously mapped as Blackearth associates of the Glenboro Association in the Carberry (1943) soil report.

Willowbend Series (WWB)

The Willowbend series consists of poorly drained Rego Humic Gleysol soil developed on moderately to strongly calcareous, stratified, deep, loamy (FSL,SL,L,SiL,CL,SiCL), recent alluvial deposits. Strata can very in texture from FS to CL depending on source area and position relative to stream channels. These soils occur in level to depressional positions of very gentle slopes on flood prone terraces and meander landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Willowbend soils are non-eroded, non-stony, and often moderately saline. They have a medium available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes sedges, rushes, reeds and willows. The majority of these soils are currently in native vegetation.

In a representative profile of Willowbend soil the solum is not developed. The profile is characterized by a moderately decomposed LH horizon, 5 to 10 cm thick, a very dark gray Ah horizon, 15 to 20 cm thick with moderate calcareousness, and a light brownish gray to very pale brown Ck horizon with many prominent mottles. Buried Ah horizons often occur throughout the soil profile.

Willowbend soils occur in close association with La Salle and Gervais soils. They are similar to Basker soils by having stratified loamy alluvium and poor drainage but differ from them in having a warmer soil climate. Willowbend soils were previously mapped as inclusions of the Assiniboine Complex in the Carberry (1957) soil rpeort.

Willowcrest Series (WWC)

The Willowcrest series consists of imperfectly drained Gleyed Black soil developed on weakly to moderately calcareous, deep, uniform, sandy (LFS,FS), lacustrine deposits. Finer textured deposits underlie the sands at depths of 1.5 to 3.5 meters. These soils occur in middle positions of gentle slopes on undulating landscapes and have moderately rapid to rapid permeability, moderate surface runoff, and a high water table during the growing season. Willowcrest soils are occasionally slightly eroded, non-stony, and very occasionally slightly saline. They have a low available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation includes aspen, willow, shrubs and prairie grasses. The majority of these soils are currently cultivated for forage or grain crops.

In a representative profile of Willowcrest soil the solum is approximately 55 cm thick. The profile is characterized by a very dark gray to very dark brown Ah horizon, 18 to 25 cm thick, a dark brown to yellowish brown Bm horizon, 25 to 40 cm thick with distinct iron mottles, a Cca horizon, 13 to 20 cm thick and a pale brown Ck horizon, with many prominent mottles.

Willowcrest soils occur in close association with Skelding, Long Plain and Lelant soils. They are similar to Almasippi soils by having imperfect drainage and sandy deposits but differ from them in having a prominent Bm horizon. Willowcrest soils were previously mapped as Black Meadow associates of the Almasippi Association in the Carberry (1957) soil report.

Winkler Series (WIK)

The Winkler series consists of moderately well drained Orthic Black soil developed on moderately calcareous, deep, stratified, clayey (SiC,C), lacustrine deposits. These soils occur in middle positions of very gentle slopes on undulating landscapes and have moderately slow permeability, moderately slow surface runoff, and a high water table during the growing season. Winkler soils are non-eroded, non-stony, and occasionally slightly saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes tall prairie grasses, shrubs and aspen-oak groves. The majority of these soils are currently cultivated for grain crop production.

In a representative profile of Winkler soil the solum is approximately 45 cm thick. The profile is characterized by a very dark gray Ah horizon, 13 to 25 cm thick, a dark brown Bm horizon, 20 to 35 cm thick with moderate medium granular to prismatic structure, and a Ck horizon, with dominantly SiC to C textures. The parent material is typically stratified with lighter textures at depth.

Winkler soils occur in close association with Dead Horse and Plum Coulee soils. They are similar to Denham soils by having an Orthic Black profile and clayey substrate but differ from them in having no loamy surface mantle. Winkler soils were previously mapped as Blackearth associates of the Rathwell Association in the Carberry (1957) soil report.

Wheatland Series (WHL)

The Wheatland series consists of well to moderately well drained Orthic Black soil developed on a mantle (60 to 95 cm) of moderately to strongly calcareous, shallow sandy (FS,LFS,LS), fluvial deposits over moderately to strongly calcareous, deep, stratified, sandy-skeletal (LS,GrLS,GrS), fluvial deposits. These soils occur in upper positions of gentle to very gentle slopes on hummocky landscapes and have rapid over very rapid permeability, moderately slow surface runoff, and a low water table during the growing season. Wheatland soils are occasionally slightly eroded, non-stony, and non-saline. They have a low available water holding capacity, medium organic matter content, and low natural fertility. Native vegetation includes oak, aspen, shrubs and prairie grasses. The majority of these soils are currently excavated for gravel or used for grazing.

In a representative profile of Wheatland soil the solum is approximately 40 cm thick. The profile is characterized by very dark gray to very dark grayish brown Ah horizon, 18 to 25 cm thick, a brown to yellowish brown Bm horizon, 12 to 24 cm thick a light yellowish brown BC horizon, 10 to 15 cm thick with lime carbonates and a Cca horizon, 5 to 8 cm thick at the sand/gravel contact. They are similar to Dorset soils by having a Orthic Black profile and sandy-skeletal substrate but differ from them in having a sandy surface mantle. Wheatland soils were previously mapped as associates of the Agassiz Association in the Carberry (1957) soil report.

Xavier Series (XVI)

The Xavier series consists of very poorly drained Typic Mesisol soil developed on deep (>160 cm), moderately decomposed, mesic fen peat deposits. These soils occur in depressional positions of level slopes on level landscapes and have moderately slow permeability, very slow surface runoff, and a high to ponded water table during the growing season. Xavier soils are non-eroded, non-stony, and non-saline. They have a high available water holding capacity, high organic matter content, and medium natural fertility. Native vegetation includes sedges, rushes, reeds and willow. The majority of these soils are currently in native vegetation.

Xavier soil is characterized by a dark yellowish brown Of horizon, 10 to 30 cm thick, which is medium acid to neutral and a thick, very dark brown, medium acid to neutral Om horizon, grading into a black, weakly acid to weakly calcareous Oh horizon. Underlying mineral strata range in texture from loam to clay.

Xavier soils are similar to Perillo soils by having very poor drainage and organic deposits but differ from them in having deep (>160 cm) rather than shallow (40-160 cm) organic deposits.

Zaplin Series (ZPI)

The Zaplin series consists of imperfectly drained Gleyed Dark Gray soil developed on moderately to strongly calcareous, deep, uniform, fine loamy (L, CL, SICL), till sediments of mixed limestone, granite and shale origin. These soils occur in lower slope positions of gentle slopes on hummocky landscapes and have moderate permeability moderately slow surface runoff and a medium water table during the growing season. Zaplin soils are non-eroded, slightly stony and occasionally slightly saline. They have a medium available water holding capacity, medium organic matter content, and medium natural fertility. Native vegetation often includes tall prairie and meadow grasses. The majority of these soils are currently used for grain crop production.

In a representative profile of Zaplin soil the solum is approximately 45 cm thick. The profile is characterized by a dark gray Ap or Ah horizon, 10 to 20 cm thick, a very dark brown Bt or Btj horizon, 20 to 30 cm thick with a few, fine, faint mottles, a grayish brown transitional BC horizon, 10 to 15 cm thick and a dark yellowish brown Ck horizon with many fine, distinct mottles.

Zaplin soils occur in close association with Dezwood and Horose soils. They are similar to Tellier soils by having a Gleyed, Dark Gray profile and a fine-loamy till substrate. However, they differ from Tellier soils in not having up to 100 cm of fine loamy lacustrine material overlying loamy glacial till. Zapline soils were previously mapped as imperfectly drained minor associates of the Pembina association in the reconnaissance soil survey of South-Central Manitoba (1943).

PART 4

USE AND MANAGEMENT INTERPRETATIONS OF SOILS

4.1 INTRODUCTION

This section provides predictions of performance or soil suitability ratings for various uses of soils based on field observations of soil and landscape characteristics, laboratory data and on observations of soil behavior under specified conditions of land use and management. Suitability ratings or interpretations are intended only to serve as guides for planners and managers. Caution, with an understanding of the limitations of the soil map must be exercised when applying suitability ratings to soil map units. The value of any rating or interpretation depends upon the nature and composition of individual map unit delineation which in turn depends on the scale of mapping and intensity of ground truthing employed in the survey.

In this section, interpretive soil information is provided for the following land use evaluations:

1. Agriculture
    a) dryland farming capability
    b) irrigation suitability
2. Engineering Uses
3. Recreation Uses

4.2 SOIL CAPABILITY FOR AGRICULTURE

Dryland Agriculture

Soil capability classification for dryland agriculture is based on an evaluation of both internal and external soil characteristics that influence soil suitability and limitations for agricultural use. In this classification, mineral soils are grouped into capability classes, and subclasses and units based on their limitations for dryland farming, risk of damage when the soils are used and the way they respond to management (Anon, 1965). There are seven capability classes, each of which groups soils together that have the same relative degree of limitation or hazard for agricultural use. The limitation becomes progressively greater from Class 1 to Class 7. The class indicates the general suitability of the soils for agriculture. The first three classes are considered capable of sustained production of common field crops, the fourth is marginal for sustained arable agriculture, the fifth is suitable only for improved permanent pasture, the sixth is capable of use only for native pasture while the seventh class is for soils and land types considered incapable of use for arable agriculture or permanent pasture.

Organic soils within the map area are rated for "potential" agricultural capability after the method of Leeson et. al. (1969). Capability ratings of organic soils for agriculture must recognize that most organic soils have little or no value for agriculture in their native state and their potential is only achieved through reclamation or development implemented with varying degrees of difficulty. Capability class definitions for organic soils are the same as for mineral soils. They are however, identified on maps and tables with the prefix "O".

Soil Capability subclasses are divisions within classes which group soils with similar kinds of limitations and hazards for agricultural use. The various kinds of limitations recognized at the subclass level are defined in Table 4.

A summary of the soils in the study area showing their major characteristics and their interpretive classification for dryland agriculture is presented in Table 5.

Definitions of the Agricultural Capability Classes

Class 1

Soils in this class have no important limitations for crop use. The soils have level or gently sloping topography; they are deep, well to imperfectly drained and have moderate water holding capacity. The soils are naturally well supplied with plant nutrients, easily maintained in good tilth and fertility; soils are moderately high to high in productivity for a wide range of cereal and special crops.

Class 2

Soils in this class have moderate limitations that reduce the choice of crops or require moderate conservation practices. The soils have good water holding capacity and are either naturally well supplied with plant nutrients or are highly responsive to inputs of fertilizer. They are moderate to high in productivity for a fairly wide range of crops. The limitations are not severe and good soil management and cropping practices can be applied without serious difficulty.

Class 3

Soils in this class have moderate limitations that restrict the range of crops or require moderate conservation practices. The limitations in Class 3 are more severe than those in Class 2 and conservation practices are more difficult to apply and maintain. The limitations affect the timing and ease of tillage, planting and harvesting, the choice of crops and maintenance of conservation practices. The limitations include one or more of the following: moderate climatic limitation, erosion, structure or permeability, low fertility, topography, overflow, wetness, low water holding capacity or slowness in release of water to plants, stoniness and depth of soil to consolidated bedrock. Under good management, these soils are fair to moderately high in productivity for a fairly wide range of field crops.

Class 4

Soils in this class have severe limitations that restrict the choice of crops or require special conservation practices or both. These soils have such limitations that they are only suited for a few crops, or the yield for a range of crops may be low, or the risk of crop failure is high. The limitations may seriously affect such farm practices as the timing and ease of tillage, planting and harvesting, and the application and maintenance of conservation practices. These soils are low to medium in productivity for a narrow range of crops but may have higher productivity for a specially adapted crop. The limitations include the adverse effects of one or more of the following: climate, accumulative undesirable soil characteristics, low fertility, deficiencies in the storage capacity or release of soil moisture to plants, structure or permeability, salinity, erosion, topography, overflow, wetness, stoniness, and depth of soil to consolidated bedrock.

Class 5

Soils in this class have very severe limitations that restrict their capability to producing perennial forage crops, and improvement practices are feasible. These soils have such serious soil, climatic or other limitations that they are not capable of use for sustained production of annual field crops. However, they may be improved by the use of farm machinery for the production of native or tame species of perennial forage plants. Feasible improvement practices include clearing of bush, cultivation, seeding, fertilizing and water control.

Some soils in Class 5 can be used for cultivated field crops provided unusually intensive management is used. Some of these soils are also adapted to special crops requiring soil conditions unlike those needed by the common crops.

Class 6

Soils in this class are capable only of producing perennial forage crops and improvement practices are not feasible. Class 6 soils have some natural sustained grazing capacity for farm animals, but have such serious soil, climatic or other limitations as to make impractical the application of improvement practices that can be carried out on Class 5 soils. Soils may be placed in this class because their physical nature prevents the use of farm machinery, or because the soils are not responsive to improvement practices, or because stock watering facilities are inadequate.

Class 7

Soils in this class have no capability for arable culture or permanent pasture because of extremely severe limitations. Bodies of water too small to delineate on the map are included in this class. These soils may or may not have a high capability for forestry, wildlife and recreation.

TABLE 4

Agricultural Capability Subclass Limitations

C - Adverse climate: This subclass denotes a significant adverse climate for crop production as compared to the "median" climate which is defined as one with sufficiently high growing season temperatures to bring field crops to maturity, and with sufficient precipitation to permit crops to be grown each year on the same land without a serious risk of partial or total crop failures.

D - Undesirable soil structure and/or low permeability: This subclass is used for soils difficult to till, or which absorb water very slowly or in which the depth of rooting zone is restricted by conditions other than a high water table or consolidated bedrock.

E - Erosion: Subclass E includes soils where damage from erosion is a limitation to agricultural use. Damage is assessed on the loss of productivity and on the difficulties in farming land with gullies.

F - Low fertility: This subclass is made up of soils having low fertility that either is correctable with careful management in the use of fertilizers and soil amendments or is difficult to correct in a feasible way. The limitation may be due to lack of available plant nutrients, high acidity or alkalinity, low exchange capacity, high levels of carbonates or presence of toxic compounds.

I - Inundation by streams or lakes: This subclass includes soils subjected to inundation causing crop damage or restricting agricultural use.

L - Coarse wood fragments: In the rating of organic soils, woody inclusions in the form of trunks, stumps and branches (>10 cm diameter) in sufficient quantity to significantly hinder tillage, planting and harvesting operations.

M - Moisture limitation: This subclass consists of soils where crops are adversely affected by droughtiness owing to inherent soil characteristics. They are usually soils with low water-holding capacity.

N - Salinity: Designates soils which are adversely affected by the presence of soluble salts.

P - Stoniness: This subclass is made up of soils sufficiently stony to significantly hinder tillage, planting, and harvesting operations. Stony soils are usually less productive than comparable non-stony soils.

R - Consolidated bedrock: This subclass includes soils where the presence of bedrock near the surface restricts their agricultural use. Consolidated bedrock at depths greater than 1 meter from the surface is not considered as a limitation, except on irrigated lands where a greater depth of soil is desirable.

T - Topography: This subclass is made up of soils where topography is a limitation. Both the percent of slope and the pattern or frequency of slopes in different directions are important factors in increasing the cost of farming over that of smooth land, in decreasing the uniformity of growth and maturity of crops, and in increasing the hazard of water erosion.

W - Excess water: Subclass W is made up of soils where excess water other than that brought about by inundation is a limitation to their use for agriculture. Excess water may result from inadequate soil drainage, a high water table, seepage or runoff from surrounding areas.

X - Cumulative minor adverse characteristics: This subclass is made up of soils having a moderate limitation caused by the cumulative effect of two or more adverse characteristics which singly are not serious enough to affect the class rating.

Irrigation Suitability

Irrigation suitability of soils is determined by evaluating the nature of both internal and external soil characteristics (PFRA, 1964). The classification of soils for irrigation suitability consists of three categories: class, subclass and unit.

The suitability class groups soils having the same relative suitability or degree of limitation or hazard for irrigation use. Four classes are utilized grading from Class 1, which is very good to Class 4, which is poor. The four classes are:

Class 1 - Very good: These are soils of fine sandy loam to clay loam texture which are well suited for irrigation use. The soils have good water retention capacity, good permeability, low salt content, good drainage and low general gradient of land surface.

Class 2 - Good: These are soils of loamy fine sand to light clay texture which are moderately well suited for irrigation use. Slight limitation to use results from soil factors such as water holding capacity, permeability, depth of material, salt content, topographic factors such as slope and pattern or drainage restrictions arising from surface drainage and depth to water table.

Class 3 - Fair: These are coarse or fine textured soils which are fair to marginally suitable because of some unfavorable characteristics that limit production and cause management problems under irrigation use. Soil, topographic or drainage factors are more restrictive than in Class 2.

Class 4 - Poor: These are soils that are considered poor to unsuitable for irrigation use because of severe drainage problems, impermeable geologic material, salinity, very low water holding capacity, very rapid permeability, topography or a combination of these problems.

The suitability subclass identifies soils with similar kinds of limitations and hazards related to both internal and external soil characteristics. The internal characteristics include both permanent and non-permanent properties; the permanent properties are those that will not change over time whereas the non-permanent properties may be altered with time by specific management. The properties which affect irrigation suitability of soil are listed as follows:

1. Internal Characteristics
   a) Permanent - Texture, uniformity and depth of geologic deposit, hydraulic conductivity and water storage capacity
   b) Non-permanent - Structure, drainage, fertility, reaction, salinity, exchangeable sodium
2. External Characteristics
   a) Topography, erosion, stoniness, vegetative cover

The classification criteria for irrigation suitability are summarized in Table 10, Appendix D. The soils of the Study areas are evalueated for irrigation suitability in Table 5.

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
AIZ /xcxx	Arizona	4M	3S
ASB	Assiniboine	2I	3SD
ASS	Almasippi	2M	2SD
ASS /oxxx	Almasippi	3MW	3SD
ASS /xcxx	Almasippi	3MT	3SD
ASS /xdxx	Almasippi	3TM	3ST
ARN	Aronet	4ME	4S
ARN /xdxx	Aronet	4ME	4S
ASZ	Agassiz	5M	4S
ASZ /xc3x	Agassiz	5M	4S
ATN	Altamont	1	3S
ATN /xcxx	Altamont	2T	3S
ATN /1cxx	Altamont	2T	3S
ATN /1c1x	Altamont	1	3S
ATN /xdxx	Altamont	3T	3ST
ATN /1dxx	Altamont	3T	3ST
BIP	Bishop	3R	4S
BIP /xcxx	Bishop	4R	4S
BIP /xcxs	Bishop	4R	4S
BKA	Birkenhead	5M	4S
BKR	Basker	6WI	4D
BMG	Blumengart	3DW	4S
BNE	Bone	2W	2D
BNE /1xxx	Bone	2W	2D
BNF	Blumenfeld	5W	4D
BNF /xxxs	Blumenfeld	5W	4DS
BNFp	Blumenfeld	6W	4SD
BUM	Blumenort	5W	4DS
CYN	Croyon	3M	2S
CYN /xcxx	Croyon	3M	2ST
CYN /xdxx	Croyon	3MT	3T
CYN1	Croyon	3M	2S
CYN1 /xcxx	Croyon	3M	2T
CYN2	Croyon	3M	2S
CXT	Capell	2M	2SD
CXT1	Capell	2W	2D
CTZ	Chortitz	3I	3D
CXV	Charman	2W	2D
CXV /xdxx	Charman	3T	3T
CAV	Carvey	5W	4D

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
CAVl	Carvey	4W	4D
CAVp	Carvey	6W	4D
CCS	Cactus	3M	3S
CKD	Crookdale	2W	2D
DGF /3dlx	Darlingford	3ET	3ST
DHO	Deadhorse	2W	4SD
DHO /xxxs	Deadhorse	3NW	4SD
DHO /xxxt	Deadhorse	4N	4SD
DLN	Danlin	2W	2SD
DLN /xdxx	Danlin	2W	2SD
DGS /xxxs	Dugas	3NW	4S
DNH	Denham	1	3S
DNH /xdxx	Denham	3T	3T
DNH /lexx	Denham	4T	4T
DOB	Dobbin	3M	3S
DOB /xcxx	Dobbin	4M	3S
DOB /xdxx	Dobbin	4M	3ST
DOB /xexx	Dobbin	4MT	4T
DOB /xfxx	Dobbin	5T	4T
DOB /lcxx	Dobbin	4M	3S
DOB /ldxx	Dobbin	4M	3ST
DOB /lxxx	Dobbin	4M	3S
DOB /2dxx	Dobbin	4M	3ST
DOT	Dorset	5M	4S
DOT /xcxx	Dorset	5M	4S
DOT /xdxx	Dorset	5M	4S
DOT /lcxx	Dorset	5M	4S
DOT /ldxx	Dorset	5M	4S
DOT /2cxx	Dorset	5M	4S
DOT /2dxx	Dorset	5M	4S
DRN /lcxx	Durnan	2T	2T
DRN /xexx	Durnan	4T	4T
DXM	Druxman	2M	2SD
DXT	Dexter	4M	4S
DXT /xcxx	Dexter	4M	4S
DZW	Dezwood	2X	3S
DZW /xcxx	Dezwood	2T	3S
DZW /lcxx	Dezwood	2T	3S
DZW /lclx	Dezwood	2T	3S
DZW /xclx	Dezwood	2T	3S

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
DZW /2cxx	Dezwood	2T	3S
DZW /2c1x	Dezwood	2T	3S
DZW /xdxx	Dezwood	3T	3ST
DZW /1dxx	Dezwood	3T	3TS
DZW /2dxx	Dezwood	3T	3ST
DZW /2d1x	Dezwood	3T	3TS
DZW /xexx	Dezwood	4T	4T
DZW /1exx	Dezwood	4T	4T
DZW /2f2x	Dezwood	5T	4T
EDK	Edkins	5W	4DS
EDK /xxxs	Edkins	5W	4DS
EEK	Elm Creek	2M	3SD
EEK /1xxx	Elm Creek	2M	3SD
EEK /xcxx	Elm Creek	2M	3SD
EGF	Eigenhof	1	1
EGF /2xxx	Eigenhof	2E	1
EGF /1cxx	Eigenhof	2T	2T
EGF /2cxx	Eigenhof	2ET	2T
EGF /xdxx	Eigenhof	3T	3T
EGF /2dxx	Eigenhof	3T	3T
EGF /xexx	Eigenhof	4T	4T
EGF /2exx	Eigenhof	4T	4T
EMV	Elm River	2I	2D
EMV /xcxx	Elm River	2I	2D
EMV1	Elm River	2I	2S
FFR	Fifere	2X	3S
FFR /1c1x	Fifere	2T	3S
FFR /xdxx	Fifere	3T	3T
FFR /1dxx	Fifere	3T	3TS
FFR /xfxx	Fifere	5T	4T
FFR /3f1x	Fifere	5T	4T
FIR	Firdale	1	1
FIR /xcxx	Firdale	2T	2T
FIR /1cxx	Firdale	2T	2T
FIR /xdxx	Firdale	3T	3T
FIR /1dxx	Firdale	3T	3T
FIR /2dxx	Firdale	3T	3T
FIR /xexx	Firdale	4T	4T
FIR /1exx	Firdale	4T	4T
FIR /2exx	Firdale	4T	4T

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
FIR /xfxx	Firdale	5T	4T
FIR /1fxx	Firdale	5T	4T
FIR /2fxx	Firdale	5T	4T
FIR /xgxx	Firdale	5T	4T
FND	Fairland	1	1
FND /xcxx	Fairland	2T	2T
FND /1cxx	Fairland	2T	2T
FND /xdxx	Fairland	3T	3T
FND /1dxx	Fairland	3T	3T
FND /xexx	Fairland	4T	4T
FND /1exx	Fairland	4T	4T
FRS	Ferris	2W	3D
FRS /xcxx	Ferris	2W	3DS
FTN /xx3x	Fortina	5W	4D
GBO	Glenboro	1	1
GBO /1xxx	Glenboro	1	1
GBO /xcxx	Glenboro	2T	2T
GBO /2xxx	Glenboro	2E	2S
GDH	Gnadenthal	1	2D
GDH /xxxs	Gnadenthal	3NW	3SD
GRO	Grover	2W	2D
GRR	Guerra	5W	4D
GRRp	Guerra	6W	4D
GTD	Gateside	2W	2D
GTD /xxxs	Gateside	3N	3S
GVS	Gervais	2W	3DS
GVS /xcxx	Gervais	2W	2DT
GVS /xdxx	Gervais	3T	3T
GYS	Grayson	5W	4D
GYV	Graysville	2W	3SD
GYV /xxxs	Graysville	3NW	4SD
HAT	Halstead	2M	1
HAT /xcxx	Halstead	2MT	2T
HAT /1cxx	Halstead	2T	2T
HAT /xdxx	Halstead	3T	3T
HAT /1dxx	Halstead	3T	3T
HAT /xexx	Halstead	4T	4T
HAT /1exx	Halstead	4T	4T
HAT /2exx	Halstead	4T	4T
HAT /xfxx	Halstead	5T	4T

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
HAT /1fxx	Halstead	5T	4T
HAT /xgxx	Halstead	6T	4T
HAT /xhxx	Halstead	7T	4T
HEB /1c1x	Hebbot	2T	3S
HIN	Hibsin	2M	3SD
HIN /1cxx	Hibsin	2T	2T
HIN /xdxx	Hibsin	3T	3T
HIN /1exx	Hibsin	4T	4T
HHF	Hochfeld	3M	2S
HMO	Hummerston	3MW	3SD
HOS	Horose	6W	4D
JIK /xcxx	Janick	2T	4S
JIK /xdxx	Janick	3T	4S
JST	Jasset	1	2D
JYL	Joyale	2W	3D
KIS /xcxx	Kingsley	2T	3S
KIS /xdxx	Kingsley	3T	3ST
KIS /1dxx	Kingsley	3T	3ST
KIS /xexx	Kingsley	4T	4T
KIS /1exx	Kingsley	4T	4T
KIS /2exx	Kingsley	4T	4T
KOT	Kronstal	2M	2SD
KRN	Kerran	4I	4D
KUD	Knudson	1	3S
LAY	Layland	5W	4D
LEI	Levine	3I	3D
LEW	Loewen	6WI	4D
LEWp	Loewen	6WI	4D
LOP	Long Plain	3M	3SD
LOP /1xxx	Long Plain	3ME	3SD
LOP /xcxx	Long Plain	3M	3SD
LOP /1cxx	Long Plain	3ME	3SD
LOP /2cxx	Long Plain	4EM	3SD
LOP /xdxx	Long Plain	4MT	3TS
LOP /xexx	Long Plain	4T	4T
LLT	Lelant	5W	4D
LLTp	Lelant	6W	4D
LLTd	Lelant	3W	4D
LLTdp	Lelant	4W	4D
LRY /2d2x	Leary	6ME	4ST

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
LRY /xexx	Leary	5M	4ST
LRY /xelx	Leary	5M	4ST
LRY /lexx	Leary	5MT	4ST
LRY /3exx	Leary	5ME	4ST
LSL	La Salle	2X	1
LSL /xcxx	La Salle	2T	2T
LSL /xdxx	La Salle	3T	3T
LSL1	La Salle	2I	3S
MFI	Mansfield	4M	4S
MFI1 /lcxx	Mansfield	4M	4S
MKY	Mockry	5W	4D
MRH /xcxx	Marringhurst	5M	4S
NBG	Neuenberg	1	2D
NBG /xxxs	Neuenberg	3NW	3SD
NSH	Narish	4W	4D
NSHp	Narish	5W	4D
NUH	Neuhorst	1	2D
NUH /xxxs	Neuhorst	3NW	3SD
NWN	Newton Siding	1	2D
NYO /xcxx	Nayler	2T	4S
NYO /xexx	Nayler	4T	4ST
NYO /lexx	Nayler	4T	4ST
NYO /2exx	Nayler	4TE	4ST
NYO /xfxx	Nayler	5T	4ST
NYO /lfxx	Nayler	5T	4ST
NYO /2fxx	Nayler	5T	4ST
OAY /xcxx	Oakley	3R	4S
OAY /xdxx	Oakley	4RT	4S
OAY /lelx	Oakley	4RT	4S
OAY /xfxx	Oakley	5T	4ST
OAY /lfxx	Oakley	5T	4ST
OBO	Osborne	3W	4D
OBO /xxxs	Osborne	3WN	4Ds
OBOp	Osborne	6W	4D
ONH	Onahan	4MW	3S
ONH /xcxx	Onahan	4MW	4S
OWK	Osterwick	5W	4D
PBI /xcxx	Pembina	2T	3S
PBI /lcxx	Pembina	2T	3S
PBI /xclx	Pembina	2T	3S

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase		Soil Name	Agricultural Capability Class	Irrigation Suitability
PBI	/1c1x	Pembina	2T	3S
PBI	/2cxx	Pembina	2TE	3S
PBI	/xdxx	Pembina	3T	3ST
PBI	/1dxx	Pembina	3TE	3ST
PBI	/1d1x	Pembina	3TE	3ST
PBI	/2d1x	Pembina	3TE	4T
PBI	/1exx	Pembina	4TE	4T
PBI	/xe1x	Pembina	4T	4T
PBI	/1e1x	Pembina	4TE	4T
PBI	/2exx	Pembina	4TE	4T
PBI	/2e1x	Pembina	4TE	4T
PBI	/xfxx	Pembina	5T	4T
PBI	/1fxx	Pembina	5T	4T
PBI	/2fxx	Pembina	5T	4T
PBI1	/xcxx	Pembina	2T	3S
PBI1	/1c1x	Pembina	2T	3S
PDA		Prodan	2W	2D
PDA	/xxxs	Prodan	3N	3S
PDA	/xcxx	Prodan	2WT	2T
PER		Perillo	O3W	4D
PER1		Perillo	O3W	4DS
PLE		Pleasant	2W	2D
PME		Plum Coulee	2W	4S
PME	/xxxs	Plum Coulee	3NW	4S
PME	/xdxx	Plum Coulee	3T	4S
POX		Poolex	4W	4D
PPR		Poplar Point	3I	2SD
PPR	/xcxx	Poplar Point	3I	2SD
PPR	/xdxx	Poplar Point	3T	3T
PTR		Petrel	2W	2D
RAM		Ramada	1	1
RAM	/1xxx	Ramada	1	1
RAM	/xcxx	Ramada	2T	2T
RAM	/1cxx	Ramada	2T	2T
RAM	/xdxx	Ramada	3T	3T
RAM	/1dxx	Ramada	3T	3T
RAM	/xexx	Ramada	4T	4T
RAM	/1exx	Ramada	4T	4T
RBK		Rosebank	2W	3SD
RBK	/2xxx	Rosebank	2W	3SD

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase		Soil Name	Agricultural Capability Class	Irrigation Suitability
RFD		Reinfeld	1	1
RGD		Rignold	1	3SD
RGD	/xxxs	Rignold	3N	3SD
RLD		Reinland	2M	2S
RMP		Rempel	1	1
RSG		Rosengart	1	1
RWL		Rathwell	1	2D
RWL	/xxxs	Rathwell	3N	3SD
SCK		Stockton	3M	3S
SCK	/0xxx	Stockton	3ME	3S
SCK	/1xxx	Stockton	3ME	3S
SCK	/2xxx	Stockton	3EM	3S
SCK	/xcxx	Stockton	3M	3S
SCK	/1cxx	Stockton	3M	3S
SCK	/2cxx	Stockton	4EM	3S
SCK	/xdxx	Stockton	3MT	3T
SCK	/1dxx	Stockton	3MT	3ST
SCK	/xexx	Stockton	4T	4T
SCK	/1exx	Stockton	4T	4T
SEE		Sewell	5W	4D
SEEp		Sewell	6W	4D
SEE	/xdxx	Sewell	5W	4D
SEU	/xdxx	Shellmouth	6E	4T
SEU	/xexx	Shellmouth	6E	4T
SEU	/xfxx	Shellmouth	6E	4T
SEU	/1fxx	Shellmouth	6E	4T
SEU	/3fxx	Shellmouth	6E	4T
SEU	/xgxx	Shellmouth	6E	4T
SEU	/xhxx	Shellmouth	7T	4T
SHX		Shilox	5M	4S
SHX	/xcxx	Shilox	5M	4S
SHX	/xdxx	Shilox	5M	3ST
SHX	/1dxx	Shilox	5M	3ST
SHX	/xexx	Shilox	5M	4ST
SHX	/xfxx	Shilox	5MT	4ST
SHX	/2fxx	Shilox	5MT	4ST
SHX	/xgxx	Shilox	6T	4ST
SKL		Skelding	5M	4S
SKL	/xcxx	Skelding	5M	4S
SKL	/xdxx	Skelding	5M	4ST

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
SKL /xexx	Skelding	5MT	4ST
SKL /xfxx	Skelding	5MT	4ST
SKL /xhxx	Skelding	6TM	4ST
SQR /xxxs	Squirrel Creek	3NW	4SD
SUE	St.Claude	2W	4SD
SUE /xxxs	St.Claude	3NW	4SD
SUE /0xxx	St.Claude	2W	4SD
TAV /1xxx	Traverse	2E	1
TDP	Tadpole	4W	4D
TDPp	Tadpole	4W	4D
TGR	Taggart	2W	2D
TGR /0xxx	Taggart	2W	2D
TLI	Tellier	2W	3D
TLI /xcxx	Tellier	2T	3SD
TLI /xexx	Tellier	4T	4T
TNT /xcxx	Trinton	2T	3S
TNT /1c1x	Trinton	2T	3S
TNT1 /xcxx	Trinton	2T	3S
TOC	Torcan	2W	2D
VDL	Vandal	3M	2S
VDL /xcxx	Vandal	3M	2S
VDL /xc1x	Vandal	3M	2S
VDL /1c1x	Vandal	3M	2S
VDL /xdxx	Vandal	3MT	4ST
VDL /1dxx	Vandal	3T	3T
VDL /1d1x	Vandal	5M	4ST
VDL /xexx	Vandal	4T	4T
VDL /1exx	Vandal	4T	4T
VDL /1e1x	Vandal	4T	4T
VDL /xfxx	Vandal	5T	4T
VDL2	Vandal	2M	2S
VDL1 /xcxx	Vandal	2MT	2TS
VDL1 /xdxx	Vandal	3T	3T
VDL1 /xexx	Vandal	4T	4T
VTL	Vartel	4M	2SD
VTL1	Vartel	2W	2SD
VDS	Vordas	5W	4D
WIK	Winkler	1	3S
WIK /xcxx	Winkler	2T	3S
WIK /xdxx	Winkler	3T	4ST

TABLE 5. AGRICULTURE CAPABILITY CLASSES FOR SOILS

Map Symbol and Phase	Soil Name	Agricultural Capability Class	Irrigation Suitability
WHL	Wheatland	4M	4S
WHL /xcxx	Wheatland	4M	4S
WWB	Willowbend	6WI	4SD
WWB /xcxx	Willowbend	5WI	4SD
WWC	Willowcrest	3M	3SD
WWC /0xxx	Willowcrest	3ME	3SD
WWC /xxxs	Willowcrest	3MN	3SD
WWC /1xxx	Willowcrest	3ME	3SD
WWC /2xxx	Willowcrest	4ME	3SD
WWC /xcxx	Willowcrest	3M	3SD
WWC /0cxx	Willowcrest	3ME	3SD
WWC /xdxx	Willowcrest	3MT	3SD
WWC /xexx	Willowcrest	4T	4T
WWD	Wellwood	1	1
WWD /xcxx	Wellwood	2T	2T
WWD /xexx	Wellwood	4T	4T
XVI	Xavier	03W	4D
ZPI /xcxx	Zaplin	2T	3DS

4.3 SOIL SUITABILITY FOR SELECTED ENGINEERING USES

This section provides information which can be used by engineers and land use planners concerned with engineering and related geotechnical aspects of soil. It is intended to supplement the information on the soil map with additional data on engineering properties of soils.

The criteria used to evaluate soil suitability for selected engineering and related recreational uses are adopted from guides found in Coen _et al_ (1977), and from guidelines developed by the Soil Conservation Service, United States Department of of Agriculture (USDA, 1971), and the Canada Soil Survey Committee (CSSC, 1973).

Definition of Soil Suitability Classes

Evaluation of soil suitability for engineering and recreation uses is based on both internal and external soil characteristics. Four soil suitability classes are used to evaluate both mineral and organic soils and hence, mapping units for selected uses. These ratings express relative degrees of suitability or limitation for potential uses of natural or essentially undisturbed soils. The long term effects of the potential use on the behavior of the soil are considered in the rating.

The four suitability class ratings are defined as follows:

Good -	Soils in their present state have few or minor limitations that would affect the proposed use. The limitations would easily be overcome with minimal cost.
Fair -	Soils in their present state have one or more moderate limitations that would affect the proposed use. These moderate limitations would be overcome with special construction, design, planning or maintenance.
Poor -	Soils in their present state have one or more severe limitations that would severely affect the proposed use. To overcome these severe limitations would require the removal of the limitation or difficult and costly alteration of the soil or of special design or intensive maintenance.
Very Poor -	Soils have one or more features so unfavorable for the proposed use that the limitation is very difficult and expensive to overcome or the soil would require such extreme alteration that the proposed use is economically impractical.

Soil Suitability Subclasses

The basic soil properties that singly or in combination with others commonly affect soil suitability for selected engineering properties and recreation uses are provided in Table 6. These subclass designations serve to identify the kind of limitation or hazard for a particular use.

Guides for Assessing Soil Suitability

Guides for assessing soil suitability for ten engineering related uses are given in Appendix D, Tables 11 to 20. These tables provide as specifically as possible, definitions of the soil properties which result in the specific suitability or degree of limitation. In assessing soil suitability for various engineering uses, the degree of suitability is determined by the most restrictive or severe rating assigned to any one of the listed soil properties. For example, if the suitability is "Good" for all but one soil property and it is estimated to be "Very Poor", then the overall rating of the soil for that selected use is "Very Poor". Suitability of individual soil properties, if estimated to be "Fair" or "Poor", can be accumulative in their effect for a particular use. Judgement is required to determine whether the severity of the combined effects of several soil properties on suitability for a particular use will result in downgrading an evaluation. This is left to the discretion of the interpreter. It is incorrect to assume that each of the major soil properties influencing a particular use has an equal effect. Class limits established for rating the suitability of individual soil properties take this into account. For a selected use, therefore, only those soil properties which most severely limit that use are specified.

Engineering description of the soils and their estimated properties significant to engineering are provided in Table 7. These data, in addition to information contained in other sections of the report have been used to rate the soils according to their suitability for ten selected engineering uses in Table 8. When using these interpretations, consideration must be given to the following assumptions:

1. Interpretations are based on predictions of soil behavior under defined conditions of use and management as specified in the preamble to each of Tables 11 through 24 (Appendix D).
2. Soil ratings do not include site factors such as nearness to towns and highways, water supply, aesthetic values, etc.
3. Soil ratings are based on natural, undisturbed soil.
4. Soil suitability ratings are usually given for the entire soil, but for some uses, they may be based on the limitations of an individual soil horizon or other earthy layer, because of its overriding importance. Ratings rarely apply to soil depths greater than 1 to 2 meters, but in some kinds of soils, reasonable estimates can be given for soil material at greater depths. It should be noted here that the term "soil" has been used throughout the report in the pedologic sense and differs in concept from that commonly used by engineers.
5. Poor and very poor soil ratings do not imply that a site cannot be changed to remove, correct or modify the soil limitations. The use of soils rated as poor depends on the nature of the limitations, whether or not the soil limitation can be altered successfully and economically, and on the scarcity of good sites.
6. Interpretations of map units do not eliminate the need for onsite evaluation by qualified professionals. Due to the variable nature of soils, and the scale of mapping, small, unmappable inclusions of soils with different properties may be present in an

area where a development is planned. The need for or importance of on-site studies depends on the use to be made of the soil and the kinds of soil and soil problems involved.

4.4 SOIL SUITABILITY FOR SELECTED RECREATION USES

This section provides interpretations of the soil suitability for recreational development. All types of soil can be used for recreational activities of some kind.

Soils and their properties determine to a large degree, the type and location of recreational facilities. Wet soils are not suitable for campsites, roads, playgrounds or picnic areas. Soils that pond and dry out slowly after heavy rains present problems where intensive use is contemplated. It is difficult to maintain grass cover for playing fields and golf courses on droughty soils. The feasibility of many kinds of outdoor activities are determined by other basic soil properties such as depth to bedrock, stoniness, topography or land pattern, and the ability of the soil to support vegetation of different kinds as related to its natural fertility.

The suitability of the various soil series and phases for selected recreation uses is shown in Table 9 according to four classes, Good, Fair, Poor and Very poor defined previously in the section on Engineering Uses. Subclasses are employed to identify the kind of limitation or hazard for a particular use. An explanation of subclass symbols are provided in Table 6.

The guidelines for various recreation uses are presented in Appendix D, Tables 21 to 24.

TABLE 6

Codes utilized to identify limitations in evaluating soil suitability for selected Engineering and Recreational Uses(Tables 8 and 9)

a	subgrade properties
b	thickness of topsoil
c	coarse fragments on surface
d	depth to bedrock
e	erosion or erodibility
f	susceptibility to frost hazard
g	contamination hazard of groundwater
h	depth to seasonal water table
i	flooding or inundation
j	thickness of slowly permeable material
k	permeability or hydraulic conductivity
l	shrink-swell properties
m	moisture limitations or deficit
n	salinity or sulphate hazard
o	organic matter
p	stoniness
q	depth to sand or gravel
r	rockiness
s	surface texture
t	topographic slope class
u	moist consistence
w	wetness or soil drainage class
z	permafrost

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses

Map Sym-bol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Elec-trical Conduc-tivity (mS/cm)	Sulphate Hazard	Shrink-Swell Poten-tial	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
AIZ	Arizona	0-25 25-100	FS-LFS FS	SM SM to SP	A-3,A-2-4 A-2-4,A-3	100 100	90-100 90-100	5-25 3-15	12.5-25.0 15.0-25.0	7.4-7.8 7.4-7.8	<0.3 <0.3	low low	low low	>2
ARN	Aronet	0-65 65-110	FS-LFS FS-LFS	SM (SW) SM	A-2-4 A-2-4,A-3	100 100	90-100 100	<35 <35	12.5-25.0 12.5-25.0	7.0-7.6 7.0-7.6	<0.3 <0.3	low low	low low	>1.5
ASB	Assiniboine	0-40 40-100	C-SiC strat. C-SiC	CH CH	A-7-6 A-7-6	100 100	100 100	90-100 90-100	.5-2.0 <.5	7.0-7.4 7.6-7.8	<1.6 1.6	low low	high high	subject to flooding
ASS	Almasippi	0-20 20-60 60-120	LFS-FS FS-LFS FS	SM (SW) SM (SW) SM	A-2-4 A-2-4 A-2-4,A-3	100 100 100	90-100 100 100	<35 <35 <35	12.5-25.0 12.5-25.0+ 12.5-25.0+	7.4-7.6 7.4-8.2 7.4-8.2	<0.3 1.6 1.6	low mod. mod.	low low low	0.8
ASZ	Agassiz	0-25 25-100	MSL S-CoGr	SP to GP GW to GP	A-1 A-1	50-70 30-50	20-30 30-40	0-15 0-15	25.0+ 25.0+	7.0-7.5 7.5-8.0	– –	none none	none none	>2
ATN	Altamont	30-80 80-100+	CL-C L-CL	CL to CH CL	A-6,A-7 A-4,A-6	85-95 85-95	75-85 55-75	60-75 40-60	.5-2.0 <.15	7.0-7.6 7.8-8.2	<0.5 <1	low low	mod. mod.	>2
BIP	Bishop	30-90 90+	C shale	CH	A-7-6	100	100	90-100	<.25	7.8-8.2	1.6	mod.-high	high	some seepage
BKA	Birken-head	0-35 35-60 60-70 70-90 90-120	FS S S-FS LS FS	SM to SP SM to SP SM to SP SM to SP SM to SP	A-2-4 A-2-4 A-2-4 A-2-4 A-2-4	100 95-100 95-100 95-100 95-100	70-85 70-85 70-85 70-85 70-85	5-15 5-15 5-15 5-15 5-15	15.0-25.0+ 15.0-25.0+ 15.0-25.0+ 15.0-25.0+ 15.0-25.0+	7.6 7.8 7.9 7.9 7.9	0.4 0.4 0.3 0.3 0.3	low low low low low	low low low low low	>1.2
BKR	Basker	20-60 60-100	FSL-SiL strat. SiL-SiCL strat.	ML to CL ML to CL	A-4,A-7-6 A-4,A-7-6	100 100	100 100	65-100 75-100	– –	7.8-8.2 7.8-8.2	– –	low low	mod. mod.	at or near surface
BMG	Blumengart	0-30 30-60 60-100	SiC-C SiC-C SiC-C	CH to OH CH to MH CH to MH	A-7-6 A-7-6 A-7-6	100 100 100	100 100 100	95-100 95-100 95-100	0.1-0.25 0.1-0.25 0.1-0.25	7.5-7.8 7.8-8.1 7.8-8.1	0.5 1.0 >2.0	low mod. mod.	high high high	0.8
BNE	Bone	0-60 60-90 90+	FSL-VFSL VFS-FSL strat. VFS-FSL	SM to ML SM to ML SM to ML	A-2-4,A-4 A-2-4,A-4 A-2-4.A-4	100 100 100	100 100 100	30-75 30-75 30-75	0.5-2.0 1.5-5.0 0.5-2.0	7.4-7.8 7.8-8.2 7.8-8.2	1.0 1.0 1.6	low low mod.	mod. mod. mod.	0.8
BNF	Blumen-feld	0-45 45-80 80-120	L VFSL-CL L-CL	CL to OL CL to ML CL to ML	A-6 A-6,A-4 A-6,A-4	100 100 100	98-100 98-100 98-100	55-75 55-75 50-75	2.5-5.0 2.5-5.0 2.5-5.0	8.0 8.0 8.0	0.7 1.6 >1.6	mod. mod. mod.-high	mod. mod.	at surface
BUM	Blumenort	0-30 30-60	SiC-C SiC-C	CH to OH CH to MH	A-7-6 A-7-6	100 100	100 100	95-100 95-100	0.1 0.1	7.0-7.5 7.0-7.5	0.5 >2.0	low mod.	high high	at surface
CAV	Carvey	0-25 25-50 50-100	SCL-L SL-L CS-GrS	SC or CL SM or CL SP or GW	A-4,A-6 A-4,A-6 A-1	100 100 var.	80-95 60-95 <60	40-75 35-75 <5	– – –	7.8-8.2 7.8-8.4 7.8-8.4	<1.6 <1.6 <1.6	low low low	mod. mod. low	seasonal at or near surface
CAV-1	Carvey-1	25-50 50-100	SL-L CS-GrS shale fragments	SM or CL SP or GW	A-4,A-6 A-1	100 Var.	60-95 <60	35-75 <5	– –	7.8-8.2 7.8-8.2	<1.6 <1.6	mod. mod.	mod. low	at surface
CCS	Cactus	0-20 20-100	LFS FS-LS	SM to SP SM to SP	A-2-4 A-3,A-2-4	100 100	85-95 85-95	5-35 3-15	15.0-25.0 15.0-25.0	6.5-7.3 7.3-7.8	<0.2 <0.2	low low	low low	>2

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
CKD	Crook-dale	25-75	SCL-CL	CL	A-6	100	100	60-80	1.5-5	7.4-7.8	-	low	mod.	seasonal 0.8
		75-100+	FS-LVFS	SM,SP,ML	A-2 to A-4	100	100	5-50	6-13	7.6-8.0	-	low	low	
CTZ	Chortitz	30-60	L-CL	MH-CL	A-7-6,A-6	100	100	98-100	1.5-7.5	8.0	<0.5	low	mod.	subject to flooding
		60-120	L-CL	MH-CL	A-7-6,A-6	100	100	98-100	1.5-7.5	8.0	<1.6	low-mod.	mod.	
CXT	Capell	0-20	SCL-L	CL	A-6,A-7-5	95-100	85-95	40-55	1.5-5.0	7.6-8.0	<1.6	low-mod.	mod.	0.8
		20-40	SCL-L	SC or CL	A-6,A-4	95-100	85-95	30-50	1.5-5.0	7.8-8.2	<1.6	low-mod.	mod.	
		40-70	Gr-SL	SM	A-1,A-2	-	50	15-30	25.0-50.0	7.8-8.2	<1.6	low-mod.	low	
		70+	GrS	SP or GP	A-1	-	<45	<5	>50.0	7.8-8.2	<1.6	low-mod.	low	
CXT-1	Capell-1	0-20	SCL-L	CL	A-6,A-7-5	95-100	85-95	40-55	1.5-5.0	7.6-8.0	<1.6	low-mod.	mod.	0.8
		20-40	SCL-L	SC or CL	A-6,A-4	95-100	85-95	30-50	1.5-5.0	7.8-8.2	<1.6	low-mod.	mod.	
		40-70	Gr-SL	SM	A-1,A-2	-	50	15-30	25.0-50.0	7.8-8.2	<1.6	low-mod.	low	
		70+	GrS + shale fragments	SP or GP	A-1	-	<45	<5	>50.0	7.8-8.2	<1.6	low-mod.	low	
CXV	Charman	0-20	CL	CL	A-7-6	100	100	90-100	<1.5	7.4-7.8	<0.5	low	mod.	1.2
		20-80	SiCL	CL	A-7-6	100	100	90-100	<1.5	7.8-8.2	<0.5	low	mod.	
		80-100	SiL-SiCL	CL	A-6,A-7-6	100	100	90-100	0.1-5.0	7.8-8.4	<0.5	low	mod.	
CYN	Croyon	0-25	SCL-L	CL	A-6	100	85-95	60-80	1.5-5.0	7.2-7.8	<0.5	low	mod.	>2
		25-50	L-CL	CL	A-6	90-100	60-95	35-75	1.5-5.0	7.8-8.2	<0.5	low	mod.	
		50-100+	CS-GrS	SP	A-1	-	20	<5	>25.0	7.8-8.2	<0.5	low	low	
CYN-1	Croyon-1	25-50	L-CL	CL	A-6	90-100	60-95	35-75	1.5-5.0	7.8-8.2	<0.5	low	mod.	>2
		50-100+	Cs-GrS shale fragments	SP	A-1	-	<20	<5	>25	7.8-8.2	<0.5	low	low	
DGF	Darling-ford	25-70	SiCL-L	ML or CL	A-4,A-6	85-90	75-95	60-85	1.5-5.0	7.8-8.2	<0.5	low	mod.	>2
		70-100+	CL-L	CL	A-4,A-6	85-90	55-75	40-60	<0.5	7.8-8.2	<1.6	low-mod.	mod.	
DGS	Dugas	0-25	SiC-C	MH to OH	A-7-6	100	100	95-100	0.1-0.25	6.5-7.4	<1.6	low-mod.	high	0.8
		25-80	SiC-C	CH	A-7-6	100	100	85-95	0.1-0.25	7.2-7.4	<1.6	low-mod.	high	
		80-100	FS-LVFS	SM to ML	A-2-4,A-4	100	100	15-80	5.0-12.5	7.8-8.2	<1.6	low-mod.	low	
DHO	Deadhorse	0-30	C-SiC	OH	A-7-6	100	100	90-100	0.03-2.5	6.5-7.4	>2.0	low	high	0.8
		30-60	C-SiC	CH to MH	A-7-6	100	100	90-100	0.03-2.5	7.4-8.0	>2.0	low-mod.	high	
		60-120	C-SiC	CH to MH	A-7-6	100	100	90-100	0.03-2.5	8.0-8.2	>2.0	high	high	
DLN	Danlin	0-40	CL	CL	A-7-6	100	100	90-100	<1.5	7.4-7.8	<0.5	low	mod.	1.2
		40-70	SiCL-SiC	CL to MH	A-6,A-7-6	100	100	95-100	<0.2	6.8-7.2	<0.2	low	mod.	
		95-110	SiL	CL to ML	A-6,A-4	100	100	95-100	0.5-2.0	7.8-8.2	<0.5	low	lot-mod.	
DNH	Denham	0-30	L-CL	OL	A-4,A-6	100	100	85-100	1.5-5.0	6.8-7.4	<0.5	low	low-mod.	>1.5
		30-90	VFSL-CL	ML to CL	A-4,A-6	100	100	85-100	1.5-5.0	7.0-7.4	<0.5	low	low-mod.	
		90-110	C	CH	A-7-6	100	100	90-100	0.5	7.8-8.2	<0.5	low	high	
DOB	Dobbin	0-35	LFS	SM to SP	A-2-4	100	85-95	5-35	15.0-25.0	6.5-7.3	<0.2	low	low	>2
		35-80	LFS	SM to SP	A-2-4	100	95-100	20-30	13.0-25.0	7.0-7.4	<0.2	low	low	
		80-110	FS-VFSL	SM to ML	A-2-4,A-4	100	100	60-70	1.5-5.0	7.4-7.8	<0.2	low	low	
DOT	Dorset	20-50	GrLS-GrS	GP-SP	A-1	35-60	-	<5	>7	7.4-7.8	-	low	low	>2
		50-100	S-Gr	GP-SP	A-1	35-60	-	<5	>10	7.8-8.2	-	low	low	
DRN	Durnan	0-25	SiL-VFSL	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.4-7.8	<0.3	low	mod.	>2
		25-60	SiL-L	ML	A-4	100	100	90-100	1.5-5.0	7.8-8.4	<0.3	low	mod.	
		60-100	SiL	ML	A-4	100	100	95-100	1.5-5.0	7.8-8.4	<0.3	low	mod.	

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
DXN	Druxman	0-20	L-CL	CL	A-4,A-6	100	90-100	70-90	1.5-5.0	7.0-7.4	<1.6			
		20-55	L-SiL	ML	A-4,A-6	100	90-100	70-90	1.5-5.0	7.6-8.0	<1.6	low	mod.	>2
		55-80	LS	SM	A-2-4	var.	<60	15-25	12.5-25	7.6-8.2	<1.6	low	low	
		80-100+	S-Gr	Sp	A-1,A-2	var.	<60	<5	>25	7.8-8.2	<1.6	low	low	
DXT	Dexter	0-20	M-CS	SP	A-1,A-3	40-75	-	<5	>20.0	6.8-7.4	<0.3	low	low	0.8
		20-50	GrLS-GrS	GP-SP	A-1	35-60	-	<5	>20.0	7.8-8.4	<0.3	low	low	
		50-100	S-Gr	GP-SP	A-1	35-60	-	<5	>20.0	7.8-8.4	<0.5	low	low	
DZW	Dezwood	25-70	SiCL-L	ML-CL	A-4,A-6	85-90	75-95	60-85	1.5-5.0	7.8-8.2	<0.5	low	mod.	>2
		70-100+	CL-L	CL	A-4,A-6	85-90	55-75	40-60	<0.5	7.8-8.2	<1.6	low-mod.	mod.	
EDK	Edkins	0-35	L	OL	A-4,A-6	100	100	55-75	3.5-5.0	6.8-7.4	<1.6	mod.	mod.-high	at or near surface
		35-85	FSL-SCL	CL to MH	A-6	100	100	60-70	3.5-5.0	7.8-8.0	<1.6	mod.	mod.-high	
		85-110	C	CH-MH	A-7-6	100	100	100	<0.1	7.8-8.0	>2.0	high	high	
EEK	Elm Creek	0-30	FS	SM	A-2-4	100	90-100	1-10	5.0-12.0	6.5-7.4	<0.5	low	low	0.8
		30-90	LFS-LVFS	SM to ML	A-2-4,A-4	100	90-100	40-60	5.0-12.0	7.0-7.6	<0.5	low	low	
		90-110	C	CH,MH	A-7-6	100	100	100	<0.1	7.8-8.2	<1.6	low-mod.	high	
EGF	Eigenhof	0-30	CL	CL to MH	A-7-6	100	100	75-100	0.2-1.0	6.5-7.4	<0.5	low	mod.-high	2.0
		30-60	CL-SiC	CL to MH	A-7-5	100	95-100	75-95	1.0-2.0	7.1-7.3	<0.5	low	mod.-high	
		60-120	CL	CL to MH	A-7-5	100	95-100	75-95	0.2-1.0	7.6-7.8	<1.6	mod.	mod.	
EMV	Elm River	0-10	SiL-SiCL	MH	A-7-6	100	100	90-100	0.5-5.0	6.8-7.4	<0.5	low	mod.	flood prone
		10-30	FSL-SiL-SiCL	SM to CL	A-4,A-7-6	100	100	65-100	0.5-5.0	7.4-7.8	<0.5	low	mod.	
		30-60	FSL-SiL-SiCL	SM to CL	A-4,A-7-6	100	100	65-100	0.5-5.0	7.4-8.2	<0.5	low	mod.	
		60-120	FSL-SiL-SiCL	SM to CL	A-4,A-7-6	100	100	65-100	0.5-5.0	7.4-8.2	<0.5	low	mod.	
EMV-1	Elm River-1	0-30	LFS	SM to SP	A-2-4	100	85-95	5-35	10-25	6.8-7.2	<0.5	low	low	flood prone
		30-75	LFS-FS	SM	A-2-4	100	95-100	15-35	10-25	6.8-7.2	<0.5	low	low	
		75-110	FS-LFS	SM(SW)	A-2-4(A-3)	100	80-95	10-35	10-25	7.8-8.2	<0.5	low	low	
FFR	Fifere	30-80	CL	CL to CH	A-6,A-7-6	90-95	80-95	75-90	1.5-5.0	6.6-7.0	<0.5	low	mod.	>2
		80-100	L-CL	CL	A-6	85-95	80-90	70-85	1.5-5.0	7.6-8.2	<0.5	low	mod.	
FIR	Firdale	0-40	CL	CL	A-7-6	100	100	90-100	0.5-2.0	6.6-7.3	<1.6	low	mod.	>2
		40-60	SiC	CL,MH	A-6,A-7-6	100	100	95-100	0.2	6.6-7.3	<0.2	low	mod.	
		60-110	SiCL	CL	A-6	100	100	95-100	0.5-2.0	6.6-7.3	<0.3	low	mod.	
		110+	SiL	CL,ML	A-6,A-4	100	100	95-100	0.5-2.0	7.4-7.8	<0.3	low	mod.	
FND	Fairland	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.0-7.4	<0.2	low	mod.	>2
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.8-8.4	<0.2	low	mod.	
		60-100	SiL	ML	A-4	100	100	95-100	1.5-5.0	7.8-8.4	<0.3	low	mod.	
FRS	Ferris	0-40	L-SiCL	CL or ML	A-4	95-100	85-95	60-95	0.5-2.0	7.6-8.0	<1.6	low	mod.	seasonal .7
		40-100	L-CL	CL	A-4,A-6	85-95	55-85	40-75	<.25	7.8-8.4	>1.6	low	mod.	
FTN	Fortina	0-20	LFS-LS	SM	A-2-4	95-100	50-75	15-30	1.5-5.0	7.4-7.8	<0.5	low	low	at surface
		20-75	S-Gr	GP or SP	A-1	36-60	-	<5	>15	7.6-8.2	<1.6	low-mod.	low	
GBO	Glenboro	0-40	L-VFSL	ML to CL	A-4,A-6	100	100	80-90	1.5-5.0	7.0-7.4		low	mod.	1.5
		40-90	LFS-L strat.	SM to ML	A-2,A-4	100	90-100	30-90	0.5-2.5	7.4-7.8		low	mod.	
		90+	FS-LFS	SM to SP	A-2,A-4	100	85-95	5-40	1.5-5	7.8-8.4		low	low	
GDH	Gnadenthal	0-30	L	OL	A-4,A-7-5	100	100	55-75	2.5-6.5	6.8-7.4	0.5-1.6	low-mod.	mod.	0.8
		30-60	VFSL-L	ML,CL	A-4,A-6	100	95-100	65-75	2.5-6.5	8.0-8.2	0.5-1.6	low-mod.	mod.	
		60-120	VFSL-SiCL	ML to CL	A-4,A-6	100	95-100	65-75	0.5-5.0	8.0-8.2	>1.6	high	mod.	

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Sym-bol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Elec-trical Conduc-tivity (mS/cm)	Sulphate Hazard	Shrink-Swell Poten-tial	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
GRO	Grover	0-40	L-SCL	ML to CL	A-4,A-6	100	100	80-90	1.5-5	7.4-7.8	-	low	mod.	seasonal
		40-90	LFS-L	SM to ML	A-2,A-4	100	90-100	30-90	1.5-5	7.8-8.4	-	low	mod.	0.7
			strat.						5-40					
		90+	FS-LFS	SM to SP	A-2,A-4	100	85-95	1.5-5	7.8-8.4	-	low	low		
GRR	Guerra	40-70	SiCL-CL	ML or CL	A-4,A-6	85-95	75-85	60-75	<0.2	7.8-8.4	>1.6	mod.- high	mod.	at
		70-100	L-CL	CL	A-4,A-6	85-90	55-75	40-60	<0.2	7.8-8.4	>1.6	mod.- high	mod.	surface
GTD	Gateside	0-60	FSL-VFSL	SM to ML	A-2-4,A-4	100	100	30-75	0.5-2.0	7.4-7.8	1.0	low	low	
		60-90	VFS-FSL	SM to ML	A-2-4,A-4	100	100	30-75	1.5-5.0	7.8-8.4	<0.5	low	low	0.8
		90+	strat.	SM to ML	A-2-4,A-4	100	100	30-75	1.5-2.0	7.8-8.4	<1.6	low-mod.	low	
			VFS-L											
GVS	Gervais	0-25	SiL-SiCL	MH	A-7-6	100	100	90-100	0.5-5.0	6.8-7.4	<0.5	low	mod.	flood
		25-100	VFSL-SiCL	ML to CL	A-4,A-6	100	100	90-100	0.5-5.0	7.6-8.2	<1.6	low-mod.	mod.	prone
GYS	Grayson	0-50	L-SiL	ML to CL	A-4,A-6	100	100	80-90	0.5-1.5	7.8-8.2	-	low	mod.	at or
		50-90	LFS-L	SM to ML	A-2,A-4	100	90-100	30-90	0.5-1.5	7.8-8.4	-	low-mod.	mod.	near
			strat.											
		90+	FS-LFS	SM to SP	A-2,A-4	100	85-95	5-35	1.5-5	7.8-8.4	-	low	low	surface
GYV	Grays-ville	30-90	VFSL-CL	ML to CL	A-5,A-7-6	100	100	65-80	2.5-6.5	7.6-8.2	<1.6	mod.	mod.	0.8
		90-100	C	CH,MH	A-7-6	100	100	95-100	.03-.1	7.8-8.2	>1.6	mod.- high	high	
HAT	Halstead	0-55	VFS-FSL	ML to CL	A-2-4,A-4	100	100	30-75	1.5-5.0	7.4-7.6	<0.2	low	mod.	
		55-150	VFSL	ML	A-4	100	100	75-85	1.5-5.0	7.4-7.8	<0.2	low	mod.	>2
		150+	L	ML to CL	A-4	100	100	90-95	1.5-5.0	7.4-7.8	<0.3	low	mod.	
HEB	Hebbot	0-25	CL-L	CL	A-6	95-100	80-95	60-90	1.5-5.0	7.2-7.6	<0.5	low	mod.	>1.5
		25-70	SiCL-L	ML or CL	A-4,A-6	85-95	75-85	55-80	1.5-5.0	7.8-8.2	<0.5	low	mod.	
		70-100	CL-L	CL	A-6	85-90	55-80	40-70	<0.5	7.8-8.2	<1.6	low	mod.	
HHF	Hochfeld	0-30	VFS-FSL	SM to SP	A-2,A-4	100	90-100	5-40	5.0-12.0	6.5-7.0	<0.5	low	low	
		30-85	VFS-FSL	SM to SP	A-2-4,A-4	100	90-100	30-70	5.0-12.0	7.2-7.6	<0.5	low	low	0.9
		85-110	FS-LVFS	SM to ML	A-2,A-4	100	90-100	20-70	7.5-15.0	7.8-8.2	<1.6	low-mod.	low	
HIN	Hibsin	0-30	FS	SM	A-2-4	100	90-100	1-10	5.0-12.0	6.5-7.4	<0.5	low	low	
		30-85	VFS-FSL	SM to SP	A-2,A-4	100	90-100	25-70	5.0-12.0	7.2-7.6	<0.5	low	low	>1.5
		85-110	SiC-C	CH,MH	A-7-6	100	100	95-100	0.1-0.25	7.8-8.2	<1.6	low-mod.	high	
HMO	Hummer-ston	0-20	LFS-FSL	SM to SP	A-2,A-4	95-100	85-95	5-40	6.0-12.5	7.3-7.6	<1.6	low	low	0.8
		20-100	FS-LFS	SM to SP	A-2-4	95-100	80-95	5-35	6.0-12.5	7.6-8.0	<1.6	low-mod.	low	
HOS	Horose	0-25	L	ML	A-4	80-85	70-75	60-65	2.0-6.0	7.5-8.0	>1.6	low	low	seasonal
		25+	L-CL	ML-CL	A-4,A-6	80-85	70-75	60-65	.1-2.0	7.7-8.4	>1.6	mod.	mod.	at surface
JIK	Janick	0-20	C-SiC	CH	A-7-6	100	100	95-100	1.5-2.5	7.0-7.4	<0.5			
		20-80	C-SiC	CH	A-7-6	100	100	95-100	.5-2.0	7.4-7.8	<0.5	low	high	>1.0
		80+	C-SiC	CH	A-7-6	100	100	95-100	<.12	7.8-8.2	<1.6	mod.	high	
JST	Josset	30-80	VFSL-L	ML to CL	A-5	100	95-100	65-75	2.6	7.0-7.4	<0.5	low	mod.	1.2
		80-110	FS-LVFS	SM to ML	A-2,A-4	100	100	15-70	5-12	7.8-8.2	<1.6	low-mod.	low	
JYL	Joyale	30-60	SiCL-CL	ML or CL	A-4,A-6	85-95	75-85	60-75	<0.2	7.8-8.2	<1.6	mod.mod.		
		60-100+	L-CL	CL	A-4,A-6	85-90	55-75	40-60	<0.1	7.8-8.2	>2	high	mod.	0.8
KIS	Kingsley	30-80	CL-C	CL to CH	A-6,A-7	85-95	75-85	60-75	.5-2.0	7.0-7.6	<0.5	low	mod.	>2
		80-100+	L-CL	CL	A-4,A-6	85-95	55-75	40-60	<.15	7.8-8.2	<1	low	mod.	
KOT	Kronstal	0-40	FSL	SM	A-2,A-4	100	95-100	5-35	5.0-15.0	6.5-7.4	<0.5	low	low	
		40-90	VFS-FSL	ML,SM	A-4,A-2-4	100	100	25-60	5.0-15.0	7.0-7.4	<0.5	low	low	
		90-110	FS-LFS	SM,SW	A-2-4,A-1	100	95-100	15-35	15.0-35.0	7.8-8.2	<1.6	low-mod.	low	

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
KRN	Kerran	0-40	C-SiC	CH	A-7-6	100	100	90-100	-	7.4-7.8	>1.6	low	high	at surface
		40-100	strat.	CH	A-7-6	100	100	90-100	-	7.8-8.4	>1.6	mod.		
KUD	Knudson	0-50	CL	CL	A-6	100	100	70-85	1.5-2.5	7.2-7.6	<0.5	low	mod.	>1.5
		50-100	SiCL	ML or CL	A-4,A-6	85-90	75-85	60-75	.5-2.0	7.8-8.2	<0.5	low	mod.	
		100-70	L-CL	CL	A-4,A-6	85-90	55-75	40-60	<0.5	7.8-8.2	<1.6	low	mod.	
LAY	Layland	0-30	FS	SM	A-2-4	100	90-100	1-10	5.0-12.0	6.5-7.4	<0.5	low	low	at surface
		30-90	LVFS	SM to ML	A-4	100	100	40-70	5.0-12.0	7.0-7.6	<0.5	low	low	
		90-110	C	CH,MH	A-7-6	100	100	100	<0.1	7.8-8.2	1.6	mod.	high	
LEI	Levine	20-100	strat. Si	ML to CL L-CL	A-4,A-7-6	100	100	65-100	.5-2.0	7.8-8.4	<1.6	low-mod.	mod.	flood prone
LEW	Loewen	30-60	L-CL	MH to CL	A-7-6	100	100	98-100	1.0-2.0	8.0	<1.6	mod.	mod.- high	flood prone
		60-120		L-CL	MH to CL	A-7-6	100	100	98-100	<1.0	8.0	>2	mod. high	mod.-
LLT	Lelant	0-30	FSL	OL	-	100	100	15-50	12.5-25.0	7.0-7.4	<1.6	low-mod.	low	at surface
		30-60	FS-FSL	SM,ML	A-2-4	100	100	10-50	12.5-25.0	7.4-8.2	<1.6	low-mod.	low	
		60-120	FS-LFS	SM(SW)	A-2-4	100	100	5-35	12.5-25.0	7.4-8.2	<1.6	low-mod.	low	
LOP	Longplain	0-25	FS-LFS	SM	A-2-4	100	100	1-10	15.0-35.0	6.8-7.4	<0.5	low	low	
		25-100	LFS-FS	SM	A-2-4	100	100	5-35	15.0-35.0	7.0-7.4	<0.5	low	low	1.2
		70-110	FS	SM(SW)	A-2-4,A-3	100	100	5-35	15.0-35.0	7.8-8.2	<0.5	low	low	
LRY	Leary	0-25	LFS	SM	A-2	85-100	90-100	10-20	15-25	7.4 7.8	<0.5	low	low	>2
		25-75	Gr	LS-FGr	GW or GP	A-1	35-60	-	<5	>25	7.8-8.4	<0.5	low	low
LSL	La Salle	0-30	SiC-SiCL	MH to CH	A-7-6	100	100	90-100	0.5-5.0	6.8-7.4	<0.2	low	mod.	flood prone
		30-60	FSL-SiC-SiCL	SM to CL	A-4,A-7-6	100	100	65-100	0.5-5.0	7.4-8.2	<0.2	low	mod.	
		60-120	FSL-SiL-SiCL	SM to CL	A-4,A-7-6	100	100	65-100	0.5-5.0	7.4-8.2	<1.6	low-mod.	mod.	
LSL	La Salle-1	0-20	Fs-LFS	SM	A-2-4	100	100	5-35	10.0-25.0	6.8-7.4	<0.5	low	low	flood prone
		30-60	LFS-FS	SM	A-2-4	100	100	15-35	10.0-25.0	7.0-7.4	<0.5	low	low	
		60-110	FS	SM(SW)	A-2-4,A-3	100	100	10-35	10.0-25.0	7.8-8.2	<0.5	low	low	
MFI	Mansfield	0-20	M-CS	Sp	A-1,A-3	90-100	40-75	<5	>20.0	6.8-7.4	<0.3	low	low	
		20-50	GrLS-GrS	GP or SP	A-1	35-60	-	<5	>20.0	7.8-8.4	<0.3	low	low	>0.8
		50-100	S-Gr	GP or Sp	A-1	35-60	-	<5	>20.0	7.8-8.4	<0.5	low	low	
MFI	Mansfield-1	0-20	M-CS	SP	A-1	90-100	40-75	<5	>20.0	6.8 7.4	<0.3	low	low	
		20-50	GrLS-GrS	GP or SP	A-1	35-60	-	<5	>20.0	6.8-8.4	<0.3	low	low	0.8
		50-100+	S-Shaly GR	GP or SP	A-1	35-60	-	<5	>20.0	6.8-7.4	<0.5	low	low	
MKY	Mockry	0-20	LFS-FS	SM to SP	A-2-4	100	80-100	10-35	-	7.6-8.0	<1.6	low-mod.	low	at surface
		20-100	FS-LFS	SW to SM	A-3,A-2-4	100	80-100	8-35	-	7.8-8.4	<1.6	low-mod.	low	
MRH	Marringhurst	0-25	LFS-FSL	SM to SP	A-2-4	100	90-100	10-35	15.0-25.0	7.4-7.8	<0.5	low	low	
		25-55	GrLS-GrS	GP or SP	A-1	35-60	-	<5	>15.0	7.8-8.0	<0.5	low	low	>2
		55-100	S-Gr	GP or SP	A-1	35-60	-	<5	>20.0	7.8 8.0	<0.5	low	low	
NBG	Neuenberg	0-40	L	OL to ML	A-4,A-7-5	100	100	55-75	1.5-5.0	6.8-7.4	1.6	mod.	low	
		40-90	VFSL-L	ML to CL	A-4,A-6	100	100	40-60	1.5 5.0	7.6 8.0	1.6	mod.	low-mod.	1.0
		90-120	FS-LVFS	SM to ML	A-2-4,A-4	100	100	50-75	5.0-15.0	7.8-8.2	>1.6	mod. high		
NSH	Narish	40-70	SiCL-CL	ML or CL	A-4,A-6	85-95	75-85	60-75	-	7.8-8.4	<1.6	low-mod.	mod.	at surface
NUH	Neuhorst	30-100	CL,SiCL	CL to CH	A-7-5,A-7-6	100	100	70-90	.5-5	7.8-8.2	1.6	mod.	mod.	1.2
		10-110	strat.	ML to CL	A-4,A-6	100	100	70-90	.5-5	7.8-8.2	>1.6	mod.	mod.	
		SiL-CL												high

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
NWN	Newton Siding	0-20 20-80 80-120	CL CL FS-VFS	ML ML SM	A-7-6 A-7-6 A-2-4,A-4	100 100 100	100 100 100	90-100 90-100 40-70	0.5-1.5 0.5-1.5 5-15	7.2-7.6 7.2-7.6 7.6-8.2	0.5-1.5 0.5-1.5 1.5-4	low-mod. low-mod. mod.	mod. mod. low	1.0
NYO	Nayler	30-80 80-110	CL L-CL	CL to CH CL	A-6,A-7-6 A-6	90-95 85-95	80-95 80-90	75-90 70-85	1.5-5.0 1.5-5.0	6.6-7.0 7.6-8.2	<0.5 <0.5	low low	mod. mod.	>2
OAY	Oakley	25-70 70-100 100+	SiCL-L CL-L shale	ML ro CL CL	A-4,A-6 A-4,A-6	85-90 85-90	75-95 55-75	60-85 40-60	1.5-5.0 <0.5	7.8-8.2 7.8-8.2	.5 .5	low low	mod. mod.	>2
OBO	Osborne	0-35 35-100	C C	OH CH	A-7-6 A-7-6	100 100	100 100	100 100	0.15 0.15	6.5-7.4 7.8-8.2	<1.6 <1.6	mod. mod.	high high	at surface
ONH	Onahan	0-20 20-100	LFS-FS LFS-FS	SW to SP SW to SP	A-2-4 A-3,A-2-4	100 100	80-100 80-100	10-35 7-35	12.5-25.0 12.5-25.0	6.8-7.2 7.8-8.2	<0.3 <0.3	low low	low low	0.8
OWK	Osterwick	0-60 60-100 100-140	FSL FSL FS-FSL	SM SM SM to ML	A-2,A-4 A-4 A-4,A-2-4	100 100 100	95-100 100 100	5-35 35-60 35-60	5.0-15.0 7.5-10.0 1.0-5.0	6.5-7.4 8.0-8.2 8.0-8.2	<0.5 <1.6 <1.6	low low-mod. low-mod.	low low low	at surface
PBI	Pembina	25-70	CL-C	MH to CL	A-6,A-7-6	85-90	75-95	60-85	1.5-5.0	7.8-8.2	<0.5	low	mod. high	>2
		70-100+	L-CL	CL	A-4,A-6	85-90	55-75	40-60	<0.5	7.8-8.2	<0.5	low	mod.	
PDA	Prodan	0-30 30-60 60-100	CL CL-SiCL VFSL-SiL	CL CL ML to CL	A-7-6 A-6,A-7-6 A-6	100 100 100	100 100 100	90-100 95-100 95-100	1.5-5.0 1.5-5.0 0.5-1.5	7.6-8.0 7.8-8.4 7.8-8.4	<0.5 <0.5 1.6	low low mod.	mod. mod. low-mod.	0.7
PER	Perillo	0-60 60-85 85-125	OM FSL-SiL FS-SiL	Pt OL SM to ML	- - A-2-4,A-4	- 100 100	- 100 100	- 40-95 25-90	- 0.5-5.0 1.5-15.0	7.8-8.2 7.8-8.2 7.8-8.2	- <1.6 <1.6	- mod. mod.	- - low	at surface
PLE	Pleasant	0-60 60-90 90+	FSL-VFSL VFS-FSL strat. VFS-FSL	SM to ML SM to ML SM to ML	A-2-4,A-4 A-2-4,A-4 A-2-4,A-4	100 100 100	100 100 100	30-75 30-75 30-75	1.5-5.0 1.5-5.0 0.5-2.0	7.4-7.8 7.8-8.2 7.8-8.2	<1.6 <1.6 1.6	low-mod. low-mod. mod.	mod. mod. mod.	0.8
PME	Plum Coulee	30-60 60-120	C SiCL-C	CH MH to CH	A-7-6 A-7-6	100 100	100 100	95-100 90-100	0.1-1.5 0.25-1.5	7.5-7.8 7.8-8.0	<1.6 >1.6	low-mod. mod.-	high high high	1.2
POX	Poolex	0-20 20-60 60-100	FSL-L VFS-FSL strat. VFS-FSL	ML to CL SM to ML SM to ML	A-4,A-6 A-2-4,A-4 A-2-4,A-4	100 100 100	100 100 100	60-85 30-75 30-75	1.5-5.0 1.5-5.0 0.5-2.0	7.6-8.0 7.8-8.4 7.8-8.4	<1.6 <1.6 1.6	low-mod. low-mod. mod.	low low low	at surface
PPR	Poplar Point	0-20 30-110	SiL-SiCL strat. SiL-CL	MH MH,CL	A-7-6 A-4,A-7-6	100 100	100 100	90-100 80-100	0.5-5.0 0.5-5.0	6.8-7.4 7.8-8.2	<0.5 <1.6	low low-mod.	mod. mod.	flood prone
PTR	Petrel	0-40 40-90 90-100+	L-SCL strat. FS-LFS	ML,CL SM,ML SM,SP	A-4,A-6 A-2,A-4 A-2-4	100 100 100	100 90-100 85-95	80-90 30-90 5-35	1.5-5 0.5-5 13-25	7.0-7.4 7.4-7.8 7.8-8.4	- - -	low low low	mod. mod. low	seasonal 0.8 to 1
RAM	Ramada	0-20 20-75 75-100	CL SiCL L-SiCL	CL CL CL	A-7-6 A-6,A-7-6 A-6,A-7-6	100 100 100	100 100 100	90-100 85-95 80-90	0.5-2.0 1.5-5.0 0.5-2.0	7.3-7.8 7.4-7.8 7.8-8.4	<1.6 <0.2 <0.3	low-mod. low low	mod. mod. mod.	>2
RBK	Rosebank	0-30 30-85 85-110	FS LFS-LVFS C,SiC	SM SM to ML CH,MH	A-2-4 A-2-4,A-4 A-7-6	100 100 100	90-100 90-100 100	1-10 40-60 95-100	5.0-12.0 5.0-12.0 0.1	6.5-7.4 7.8-8.2 7.8-8.2	<0.5 <1.6 <1.6	low low-mod. low-mod.	low low high	0.8

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Symbol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Electrical Conductivity (mS/cm)	Sulphate Hazard	Shrink-Swell Potential	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
RFD	Reinfeld	0-50	L	OL	A-4,A-6	100	95-100	55-75	5.0-7.5	6.5-7.4	<0.5	low	low-mod.	
		50-90	strat.	ML to MH	A-4,A-6	100	100	70-95	0.2-5.0	7.8-8.2	<1.6	low-mod.	low-mod.	
		90-100	VFS-SiCL											
RGD	Rignold	0-40	L	OL	A-4,A-6	100	95-100	55-75	5.0-7.5	6.5-7.4	<0.5	low	low-mod	0.8 (perched)
		40-90	VFSL-CL	ML to CL	A-4,A-6	100	100	70-100	3.0-10.0	7.4-8.0	<0.5	low	mod.	
		90-110	C	CH,MH	A-7-6	100	100	100	<0.1	7.8-8.2	<1.6	low-mod.	high	
RLD	Reinland	0-30	FSL	SM	A-2,A-4	100	95-100	5-35	7.0-15.0	6.5-7.4	<1.6	low-mod.	low	>1.2
		30-75	FSL-LVFS	SM to ML	A-2-4,A-4	100	95-100	30-85	7.0-15.0	7.8-8.2	<1.6	low-mod.	low	
		75-110	FS-LVFS	SM to ML	A-2-4,A-4	100	95-100	25-75	7.0-20.0	7.8-8.2	1.6	mod.	low	
RMP	Rempel	0-20	CL	CL	A-7-6	100	100	90-100	0.5-2.0	7.3-7.8	<1.6	low-mod.	mod.	
		20-75	SiCL	CL	A-6,A-7-6	100	100	85-95	1.5-5.0	7.4-7.8	<0.2	low	mod.	
		75-100	L-SiCL	CL	A-6,A-7-6	100	100	80-90	0.5-2.0	7.8-8.4	<0.3	low	mod.	
RSG	Rosengart	0-35	L-CL	OL	A-4,A-6	100	95-100	55-75	1.0-5.0	6.5-7.4	<0.5	low	low	>1.5
		35-80	VFSL-L-SiL	ML	A-4	100	100	90-100	1.0-5.0	7.2-7.8	<0.5	low	low	
		80-110	FS-LVFS	SM to ML	A-2-4,A-4	100	100	25-75	7.0-20.0	7.8-8.2	<1.6	low-mod.	low	
RWL	Rathwell	30-100	CL,SiCL	CL to CH	A-7-5,A-7-6	100	100	70-90	.5-.5	7.8-8.2	1.6	mod.	mod.	1.2
		70-110	strat. SiL-CL	ML to CL	A-4,A-6	100	100	70-90	.5-.5	7.8-8.2	>1.6	mod.-high	mod.	
SCK	Stockton	0-30	LFS	Sm to SP	A-2-4	100	85-95	5-35	10.0-25.0	6.8-7.2	<0.5	low	low	>2
		30-75	LFS-FS	SM	A-2-4	100	95-100	15-35	10.0-25.0	6.8-7.2	<0.5	low	low	
		75-110	FS-LFS	SM(SW)	A-2-4,A-3	100	80-95	10-35	10.0-25.0	7.8-8.2	<0.5	low	low	
SEE	Sewell	0-20	LFS-FSL	SM,SP	A-2-4,A-4	100	100	5-50	-	7.6-8.0	<1.6	low-mod.	low	at surface
		20-100	FS-LVFS	SM,SP,ML	A-2-4,A-4	100	100	5-50	-	7.8 8.4	<1.6	low mod.	low	
SHX	Shilox	0-20	LFS-FS	SM to SP	A-2-4	100	80-100	10-35	15.0-25.0	6.6-7.2	<0.1	low	low	>2
		20-100	FS-LFS-S	SW to SP	A-3,A-2-4	100	60-90	7-35	15.0-25.0	7.6-8.0	<0.1	low	low	
SKL	Skelding	0-25	FS	SM	A-2-4	100	100	<10	>25.0	6.5-7.4	<0.1	low	low	>2
		25-100	FS	SM,SW	A-2,A-3	100	70-100	<10	>25.0	6.5-7.4	<0.1	low	low	
SQR	Squirrel Creek	0-25	L-CL	SM	A-4,A-5	100	100	25-40	1.0-5.0	7.4-8.2	1.6	low	low	0.8
		25-85	SiL-L	ML	A-4	100	95-100	40-70	<0.5	8.0-8.2	>1.6	high	low	
		85-110	C,SiC	CH,MH	A-7-6	100	100	100	<0.1	7.8-8.2	>1.6	high	high	
SUE	St. Claude	0-25	L-CL	SM	A-4,A-5	100	100	25-40	1.0-5.0	7.4-8.2	1.6	low	low	0.8
		25-75	SiL-L	ML	A-4	100	95-100	40-70	0.5	8.0-8.2	1.6	mod.-high	low	
		75-110	FS-LFS	SM	A-2-4,A-3	100	85-100	5-35	7.0-20.0	7.8-8.2	1.6	mod.	low	
TAV	Traverse	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.0-7.4	<0.2	low	mod.	>2
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.8-8.4	<0.2	low	mod.	
		60-100	SiL	ML	A-4	100	100	90-100	1.5-5.0	7.8-8.4	<0.3	low	mod.	
TDP	Tadpole	0-30	CL	CL	A-7-6	100	100	90-100	-	7.6-8.0	<1.6	low-mod.	mod.	at surface
		30-60	CL-SiCL	CL	A-6,A-7-6	100	100	95-100	-	7.8-8.4	<1.6	low-mod.	mod.	
		60-100	strat.VFSL-SiL-SiCL	ML to CL	A-4,A-6	100	100	95-100	-	7.8-8.4	<1.6	low-mod.	mod.	
TGR	Taggart	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	0.5-1.5	7.6-8.0	<0.5	low	low	0.8
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	0.5-1.5	7.8-8.4	<0.5	low	low	
		60-100	SiL	ML	A-4	100	100	95-100	0.5-1.5	7.8-8.4	<1.6	low-mod.	low	
TLI	Tellier	40-80	L-SiCL	CL or ML	A-4	85-100	75-95	60-90	.5-1.5	7.8-8.2	<.5	low	mod.	1.2
		80-100+	L-CL	CL	A-4,A-6	85-90	55-80	40-70	<.2	7.8-8.2	<1.6	low-mod.	mod.	
TOC	Torcan	0-25	VFSL-SiL	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.0-7.4	<0.5	low	low	1.0
		25-60	SiL-L	ML	A-4,A-6	100	100	90-100	1.5-5.0	7.4-7.8	<0.5	low	low-mod.	
		60-100	SiL	ML	A-4	100	100	95-100	0.5-1.5	7.8-8.4	<1.6	low-mod.	low-mod.	

Table 7. Engineering Description of Soils and Their Estimated Properties Significant to Engineering Uses (continued)

Map Sym-bol	Soil Series Name	Depth (cm)	Textural Classification			% Passing Sieve			Disturbed Hydraulic Conductivity (cm/hr)	Reaction (pH)	Elec-trical Conduc-tivity (mS/cm)	Sulphate Hazard	Shrink-Swell Poten-tial	Depth to Seasonal Water Table (m)
			USDA	Unified	AASHO	No. 10 2.0 mm	No. 40 0.42 mm	No. 200 0.074 mm						
TNT	Trinton	25-50 50-100+	L-CL Cs-GrS	CL GP-SP	A-6 A-1	90-100 -	60 <20	35-65 <5	1.5-5.0 >25	7.5-8.0 7.8-8.0	<0.5 <0.5	low low	mod. low	>2
TNT-1	Trinton-1	25-50 50-100+	L-CL Cs-Grs+ shale fragments	CL GP-SP	A-6 A-1	90-100 -	60 <20	35-65 <5	1.5-5.0 >25	7.8-8.0 7.8-8.0	<0.5 <0.5	low low	mod. low	>2
VDL	Vandal	25-50 50-100+	L-CL CS-GR	CL GP-SP	A-6 A-1	90-100 -	60 <20	35-65 <5	1.5-5.0 >25	7.8-8.0 7.8-8.0	<0.5 <0.5	low low	mod. low	>2
VDL-1	Vandal-1	25-50 50-100+	L-CL CS-GrS+ shale fragments	CL SP	A-6 A-1	90-100 -	60-95 <20	35-65 <5	1.5-5.0 >25	7.8-8.2 7.8-8.2	<0.5 <0.5	low low	mod. low	>2
VDS	Vordas	0-25 25-60 60-100	SiL-CL SiL-L SiL-L	CL ML ML	A-6,A-7-6 A-4,A-6 A-4,A-6	100 100 100	100 100 100	95-100 90-100 95-100	- - -	7.6-8.0 7.8-8.4 7.8-8.4	<1.6 <1.6 1.6	low-mod. low-mod. mod.	mod. mod. mod.	at surface
VTL	Vartel	0-70 70+	L-CL CS-Gr	CL GP-SP	A-6 A-2	90-100 -	80-95 <20	35-65 <5	1.5-5.0 >25	7.8-8.0 7.8-8.0	<0.5 <0.5	low low	mod. low	0.8
VTL-1	Vartel-1	0-40 40-70 70+	L-CL Gr-SL GrS+ shale fragments	CL SM SP or GP	A-6,A-7-5 A-1,A-2 A-1	95-100 - -	85-95 50 <45	40-55 15-30 <5	1.5-5.0 25.0-50.0 >50.0	7.6-8.0 7.8-8.2 7.8-8.2	<1.6 <1.6 <1.6	low-mod. low-mod. low-mod.	mod. low low	0.8
WHL	Wheatland	0-20 20-40 40-100	SL LFS-LS MS,CS,FGr	SM SP,SM,S GP,SP	A-2-4 W A-1,A-2	100 A-2-4 50-100	50-75 100 20-60	10-35 50-75 2	12-25 10-35 >25	7.0-7.4 12-25 7.8-8.2	<0.5 7.4-7.8 <0.5	low <0.5 low	low low low	2 low
WIL	Winkler	0-30 30-60 60-120	CL-C C SiCL-C strat.	CH CH CH,MH	A-7-6 A-7-6 A-7-6	100 100 100	100 100 100	90-100 90-100 90-100	1.0-2.5 0.1-0.25 0.1-0.25	6.8-7.0 7.5-7.8 7.8-8.0	<0.5 <0.5 1.6	low low low-mod.	high high high	2
WWB	Willow-bend	0-35 35-100	L-CL strat. FS-SiCL	OL,OH ML,CL	A-4,A-7 A-4,A-6	100 100	100 100	65-100 30-100	- variable	6.5-7.4 7.8-8.2	<1.6 <1.6	low low-mod.	low low-mod.	flood prone
WWC	Willow-crest	0-60 60-120	FS FS-LFS	SM SM,SW	A-2-4 A-2-4,A-3	100 100	100 100	1-10 5-35	15.0-50.0 15.0-50.0	6.5-7.4 7.8-8.2	<1.6 <1.6	low low-mod.	low low	1.0
WWD	Wellwood	0-40 40-85 85-100	SCL-CL SCL-CL FS-LVFS	CL CL SM,SP,ML	A-6 A-6 A-2,A-6	100 100 100	100 100 100	60-80 60-80 5-50	1.5-5.0 1.5-5.0 6-13	7.0-7.4 7.8-8.4 7.8-8.4	- -	low low low	mod. mod.	>2
XVI	Xavier	0-130 130-150	Om FS-SiL	Pt SM,ML	- A-2-4,A-4	- 100	- 100	- 25-90	- 1.5-15.0	7.8-8.2 7.8-8.2	1.6 1.6	mod. mod.	 low	at surface
ZPI	Zaplin	0-40 40-100	L-SiCL L-CL	CL,ML CL	A-4 A-4,A-6	95-100 85-95	85-95 55-85	60-95 40-75	.5-2.0 <.25	7.6-8.0 7.8-8.4	<1.6 <1.6	low mod.	mod. mod.	seasonal .7

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
AIZ /xcxx	Arizona	Vb	Fa	G	G	G	Vs	Vk	Vs	Vk	Gg
ASB	Assiniboine	Psi	Va	Pal	Pi	Pai	Pis	Pi	Ps	Vi	Vk
ASS	Almasippi	Ps	Fa	Fw	Pw	Fw	Vs	Vk	Fs	Vkh	Ph
ASS /oxxx	Almasippi	Ps	Fa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
ASS /xcxx	Almasippi	Ps	Fa	Fw	Pw	Fw	Vs	Vk	Fs	Vkh	Ph
ASS /xdxx	Almasippi	Ps	Fa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
ARN	Aronet	Ps	Fa	G	Fw	G	Vs	Vk	Vs	Vk	Gg
ARN /xdxx	Aronet	Ps	Fa	G	Fw	G	Vs	Vk	Vs	Vk	Gg
ASZ	Agassiz	Ps	G	G	G	G	Vsk	Vk	Vs	Vak	Gg
ASZ /xc3x	Agassiz	Psp	G	Fp	Pp	Fp	Vsk	Vk	Vs	Vak	Gg
ATN	Altamont	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
ATN /xcxx	Altamont	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
ATN /lcxx	Altamont	Fbs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
ATN /lclx	Altamont	Fsb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
ATN /xdxx	Altamont	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
ATN /ldxx	Altamont	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
BIP	Bishop	Ps	Va	Pa	Paw	Pa	Vd	Fw	Pds	Pd	Pkd
BIP /xcxx	Bishop	Ps	Va	Pa	Paw	Pa	Vd	Fw	Pds	Pd	Pkd
BIP /xcxs	Bishop	Ps	Va	Pa	Paw	Pa	Vd	Fw	Pds	Pd	Pkd
BKA	Birkenhead	Ps	G	G	G	G	Vks	Vk	Vs	Vk	Gg
BKR	Basker	Pi	Va	Pw	Vi	Vi	Vi	Viw	Pw	Vi	Vi
BMG	Blumengart	Ps	Va	Pa	Paw	Pa	Phs	Fw	Ps	Pi	Vk
BNE	Bone	G	Va	Fw	Pw	Fw	Pw	Fw	G	Ph	Ph
BNE /lxxx	Bone	Fb	Va	Fw	Pw	Fw	Pw	Fw	G	Ph	Ph
BNF	Blumenfeld	Fs	Va	Pw	Pw	Pw	Vw	Pw	Pw	Vh	Vh
BNF /xxxs	Blumenfeld	Pn	Va	Pw	Pw	Pw	Vw	Pw	Pw	Vh	Vh
BNFp	Blumenfeld	G	Va	Vw	Pw	Pw	Vw	Vw	Vw	Vh	Vh
BUM	Blumenort	Ps	Va	Pwa	Vh	Paw	Vhw	Pwi	Psw	Pi	Vkh
CYN	Croyon	Fbs	Fq	G	G	G	Vsk	Vk	Ps	Vka	Gg
CYN /xcxx	Croyon	Fbs	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
CYN /xdxx	Croyon	Fts	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
CYN1	Croyon	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
CYN1 /xcxx	Croyon	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
CYN2	Croyon	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
CXT	Capell	Fbs	Fq	Fw	Pw	Fw	Vsk	Vkg	Ps	Vk	Phg
CXT1	Capell	Fbs	Fq	Fw	Pw	Fw	Vsk	Vkg	Pd	Vk	Phg
CTZ	Chortitz	Fsi	Va	Faw	Pw	Faw	Pw	Fiw	Fs	Pi	Ph
CXV	Charman	Fsb	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fa	Ph
CXV /xdxx	Charman	Fst	Va	Faw	Pw	Faw	Pw	Fw	Fs	Pt	Ph
CAV	Carvey	Fs	Faq	Pw	Pw	Pw	Vwg	Vhk	Pw	Vk	Vhg
CAV1	Carvey	Fs	Faq	Pw	Pw	Pw	Vwg	Vkh	Pw	Vk	Vhg
CAVp	Carvey	G	Faq	Vw	Vw	Pw	Vwg	Vwk	Vw	Vkh	Vhg
CCS	Cactus	Pbs	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
CKD	Crookdale	Fsb	Paq	Fw	Pw	Fwa	Vs	Pk	Fs	Pa	Fkh
DGF /3dlx	Darlingford	Vb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
DHO	Deadhorse	Ps	Va	Pa	Pwa	Pa	Psw	Fw	Ps	Fh	Pkh
DHO /xxxs	Deadhorse	Psn	Va	Pa	Pwa	Pa	Psw	Fw	Ps	Fh	Pkh
DHO /xxxt	Deadhorse	Psn	Va	Pa	Pwa	Pa	Psw	Fw	Ps	Fh	Pkh
DLN	Danlin	Fs	Va	Faw	Pw	Fw	Pw	Fw	Fs	Fa	Ph
DLN /xdxx	Danlin	Fst	Va	Faw	Pw	Fw	Pw	Fw	Fs	Pt	Ph
DGS /xxxs	Dugas	Psn	Va	Fwa	Pwa	Pa	Psw	Fw	Ps	Pk	Fkh
DNH	Denham	G	Va	Fa	Fa	Fa	Ps	G	G	Fa	Pd
DNH /xdxx	Denham	Ft	Va	Fa	Fa	Fa	Ps	G	G	Pt	Pd
DNH /lexx	Denham	Pt	Va	Fa	Fat	Fat	Ps	Ft	Ft	Vt	Pd
DOB	Dobbin	Ps	Fa	G	G	G	Pk	Pk	Fs	Pk	Gg
DOB /xcxx	Dobbin	Ps	Fa	G	G	G	Pk	Pk	Fs	Pk	Gg
DOB /xdxx	Dobbin	Ps	Fa	G	G	G	Pk	Pk	Fs	Pkt	Gg
DOB /xexx	Dobbin	Pst	Fa	G	Ft	Ft	Pk	Pk	Fts	Vt	Ft
DOB /xfxx	Dobbin	Vt	Fa	Ft	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
DOB /lcxx	Dobbin	Ps	Fa	G	G	G	Pk	Pk	Fs	Pk	Gg

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
DOB /1dxx	Dobbin	Ps	Fa	G	G	G	Pk	Pk	Fs	Pkt	Gg
DOB /1xxx	Dobbin	Ps	Fa	G	G	G	Pk	Pk	Fs	Pk	Gg
DOB /2dxx	Dobbin	Pbs	Fa	G	G	G	Pk	Pk	Fs	Pkt	Gg
DOT	Dorset	Pbs	G	G	G	G	Vsk	Vkg	Vs	Vak	Gg
DOT /xcxx	Dorset	Pbs	G	G	G	G	Vsk	Vkg	Vs	Vak	Gg
DOT /xdxx	Dorset	Pbs	G	G	G	G	Vsk	Vkg	Vs	Vak	Gg
DOT /1cxx	Dorset	Pbs	G	G	G	G	Vsk	Vkg	Vs	Vak	Gg
DOT /1dxx	Dorset	Pbs	G	G	G	G	Vsk	Vkg	Vs	Vak	Gg
DOT /2cxx	Dorset	Vb	G	G	G	G	Vsk	Vkg	Vs	Vka	Gg
DOT /2dxx	Dorset	Vb	G	G	G	G	Vsk	Vkg	Vs	Vka	Gg
DRN /1cxx	Durnan	Fb	Va	Fa	Fa	Fa	G	G	G	Fat	Fk
DRN /xexx	Durnan	Pt	Va	Fa	Fat	Fat	G	Ft	Ft	Vt	Fkt
DXM	Druxman	Fs	Fq	Fw	Pw	Fw	Vsg	Vkg	Fs	Vkg	Phg
DXT	Dexter	Pbs	G	Fw	Pw	Fw	Vsk	Vk	Vs	Vka	Ph
DXT /xcxx	Dexter	Pbs	G	Fw	Pw	Fw	Vks	Vk	Vs	Vak	Phg
DZW	Dezwood	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
DZW /xcxx	Dezwood	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
DZW /1cxx	Dezwood	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
DZW /1c1x	Dezwood	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
DZW /xc1x	Dezwood	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
DZW /2cxx	Dezwood	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
DZW /2c1x	Dezwood	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
DZW /xdxx	Dezwood	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
DZW /1dxx	Dezwood	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
DZW /2dxx	Dezwood	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
DZW /2d1x	Dezwood	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
DZW /xexx	Dezwood	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fts	Vt	Fkt
DZW /1exx	Dezwood	Ptb	Va	Fa	Fat	Fat	Fs	Ft	Fts	Vt	Fkt
DZW /2f2x	Dezwood	Vt	Va	Fat	Pt	Pt	Fst	Pt	Pt	Vt	Pt
EDK	Edkins	Fsb	Va	Pw	Vwh	Pw	Vw	Pw	Pw	G	Vh

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
EDK /xxxs	Edkins	Pn	Va	Pw	Vhw	Pw	Vw	Pw	Pw	G	Vh
EEK	Elm Creek	Ps	Pa	Fw	Pw	Fw	Pw	Pk	Fs	G	Pdh
EEK /1xxx	Elm Creek	Ps	Pa	Fw	Pw	Fw	Pw	Pk	Fs	G	Pdh
EEK /xcxx	Elm Creek	Ps	Pa	Fw	Pw	Fw	Pw	Pk	Fs	G	Pdh
EGF	Eigenhof	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
EGF /2xxx	Eigenhof	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
EGF /1cxx	Eigenhof	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
EGF /2cxx	Eigenhof	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
EGF /xdxx	Eigenhof	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
EGF /2dxx	Eigenhof	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
EGF /xexx	Eigenhof	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
EGF /2exx	Eigenhof	Pbt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
EMV	Elm River	Fi	Va	Fa	Pi	Fi	Pi	Pi	Fs	Pi	Pi
EMV /xcxx	Elm River	Fi	Va	Fa	Pi	Fi	Pi	Pi	Fs	Pi	Pi
EMV1	Elm River	Ps	Pa	G	Pi	Fi	Pi	Pi	Fs	Pi	Pi
FFR	Fifere	Fb	Va	Fa	Fa	Fa	Pk	Pk	Fs	Fk	Fk
FFR /1c1x	Fifere	Vb	Va	Fa	Fa	Fa	Pk	Pk	Fs	Ftk	Fk
FFR /xdxx	Fifere	Vb	Va	Fa	Fa	Fa	Pk	Pk	Fs	Pt	Fk
FFR /1dxx	Fifere	Vb	Va	Fa	Fa	Fa	Pk	Pk	Fs	Pt	Fk
FFR /xfxx	Fifere	Vbt	Va	Fat	Pt	Pt	Pk	Ptk	Pt	Vt	Pt
FFR /3f1x	Fifere	Vbt	Va	Fat	Pt	Pt	Pk	Ptk	Pt	Vt	Pt
FIR	Firdale	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fa	Fk
FIR /xcxx	Firdale	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fat	Fk
FIR /1cxx	Firdale	Fsb	Va	Fa	Fa	Fa	Fs	G	Fs	Fat	Fk
FIR /xdxx	Firdale	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
FIR /1dxx	Firdale	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
FIR /2dxx	Firdale	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
FIR /xexx	Firdale	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
FIR /1exx	Firdale	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
FIR /2exx	Firdale	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
FIR /xfxx	Firdale	Vt	Va	Fta	Pt	Pt	Fst	Pt	Pt	Vt	Pt
FIR /1fxx	Firdale	Vt	Va	Fta	Pt	Pt	Fst	Pt	Pt	Vt	Pt
FIR /2fxx	Firdale	Vt	Va	Fta	Pt	Pt	Fst	Pt	Pt	Vt	Pt
FIR /xgxx	Firdale	Vt	Va	Pt	Vt	Vt	Pt	Vt	Vt	Vt	Vt
FND	Fairland	G	Va	Fa	Fa	Fa	G	G	G	Fak	Fk
FND /xcxx	Fairland	G	Va	Fa	Fa	Fa	G	G	G	Fat	Fk
FND /1cxx	Fairland	Fb	Va	Fa	Fa	Fa	G	G	G	Fat	Fk
FND /xdxx	Fairland	Ft	Va	Fa	Fa	Fa	G	G	G	Pt	Fk
FND /1dxx	Fairland	Fbt	Va	Fa	Fa	Fa	G	G	G	Pt	Fk
FND /xexx	Fairland	Pt	Va	Fa	Fat	Fat	G	Ft	Ft	Vt	Ftk
FND /1exx	Fairland	Pt	Va	Fa	Fat	Fat	G	Ft	Ft	Vt	Ftk
FRS	Ferris	Fbs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Fk
FRS /xcxx	Ferris	Fsb	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fkt	Fk
FTN /xx3x	Fortina	Pps	Ph	Pw	Pwp	Pw	Vw	Pw	Ppw	Vhk	Vh
GBO	Glenboro	G	Pa	G	G	G	Pk	G	G	Pka	Gg
GBO /1xxx	Glenboro	Fb	Pa	G	G	G	Pk	G	G	Pka	Gg
GBO /xcxx	Glenboro	G	Pa	G	G	G	Pk	G	G	Pka	Gg
GBO /2xxx	Glenboro	Fb	Pa	G	G	G	Pk	G	G	Pka	Gg
GDH	Gnadenthal	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Fk
GDH /xxxs	Gnadenthal	Pn	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Fk
GRO	Grover	G	Paq	G	Pw	Fw	Pw	Fw	G	Pka	Fh
GRR	Guerra	Fs	Va	Vh	Vh	Pw	Vw	Vh	Pw	Vh	Vh
GRRp	Guerra	G	Va	Vwa	Vhw	Vw	Vhw	Vhw	Vw	Vh	Vh
GTD	Gateside	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fk	Ph
GTD /xxxs	Gateside	Pn	Va	Faw	Pw	Faw	Pw	Fw	G	Fk	Ph
GVS	Gervais	Pi	Va	Faw	Piw	Fiw	Piw	Pi	Fs	Pi	Phi
GVS /xcxx	Gervais	Pi	Va	Faw	Piw	Fiw	Piw	Pi	Fs	Pi	Phi
GVS /xdxx	Gervais	Pi	Va	Faw	Piw	Fiw	Piw	Pi	Fs	Pid	Phi
GYS	Grayson	G	Ph	Pw	Pw	Pw	Vw	Pw	Pw	Ph	Ph
GYV	Graysville	G	Va	Faw	Pw	Faw	Psw	Fw	G	G	Pdh

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
GYV /xxxs	Graysville	Pn	Va	Faw	Pw	Faw	Psw	Fw	G	G	Pdh
HAT	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	G	G
HAT /xcxx	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Ft	G
HAT /lcxx	Halstead	G	Va	Fa	Fa	Fa	Pk	Pk	G	Ft	G
HAT /xdxx	Halstead	Ft	Va	Fa	Fa	Fa	Pk	Pk	G	Pt	G
HAT /ldxx	Halstead	Ft	Va	Fa	Fa	Fa	Pk	Pk	G	Pt	G
HAT /xexx	Halstead	Pt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ft
HAT /lexx	Halstead	Pt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ft
HAT /2exx	Halstead	Pbt	Va	Fa	Fat	Fat	Pk	Pk	Ft	Vt	Ft
HAT /xfxx	Halstead	Vt	Va	Pt	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
HAT /lfxx	Halstead	Vt	Va	Pt	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
HAT /xgxx	Halstead	Vt	Va	Vt	Vt	Vt	Ptk	Vt	Vt	Vt	Vt
HAT /xhxx	Halstead	Vt	Va	Vt	Vt	Vt	Vt	Vt	Vt	Vt	Vt
HEB /lclx	Hebbot	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fat	Pk
HIN	Hibsin	G	Pa	Pa	Pa	G	Ps	Pk	G	Fa	Pd
HIN /lcxx	Hibsin	G	Pa	Pa	Pa	G	Ps	Pk	G	Fat	Pd
HIN /xdxx	Hibsin	Ft	Pa	Pa	Pa	G	Ps	Pk	G	Pt	Pd
HIN /lexx	Hibsin	Pt	Pa	Pa	Pa	Ft	Ps	Pk	Ft	Vt	Pd
HHF	Hochfeld	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	G
HMO	Hummerston	Ps	Pa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Ph
HOS	Horose	Fs	Va	Vh	Pw	Pw	Vhw	Vh	Pw	Fk	Vh
JIK /xcxx	Janick	Ps	Va	Pa	Pa	Pa	Ps	G	Ps	Ft	Vk
JIK /xdxx	Janick	Ps	Va	Pa	Pa	Pa	Ps	G	Ps	Pt	Vk
JST	Jasset	G	Paq	Faw	Pw	Faw	Pkh	Pk	G	Pk	Fh
JYL	Joyale	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Fhk
KIS /xcxx	Kingsley	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
KIS /xdxx	Kingsley	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
KIS /ldxx	Kingsley	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
KIS /xexx	Kingsley	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
KIS /lexx	Kingsley	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
KIS /2exx	Kingsley	Ptb	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
KOT	Kronstal	G	Va	Fwa	Pw	Fwa	Phk	Pk	G	Pk	Fhk
KRN	Kerran	Pis	Va	Paw	Vi	Vi	Vih	Vih	Psw	Vi	Vih
KUD	Knudson	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
LAY	Layland	G	Va	Pw	Pw	Pw	Vw	Pw	Pw	Fa	Vh
LEI	Levine	Fis	Va	Faw	Piw	Pi	Piw	Pi	Fs	Vi	Pi
LEW	Loewen	Pi	Va	Pw	Pw	Vi	Viw	Vi	Pw	Vi	Vi
LEWp	Loewen	Vw	Va	Vw	Vw	Vai	Viw	Viw	Vsw	Vi	Vi
LOP	Long Plain	Ps	Fa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fhg
LOP /1xxx	Long Plain	Ps	Fa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fhg
LOP /xcxx	Long Plain	Ps	Fa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fhg
LOP /1cxx	Long Plain	Ps	Fa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fhg
LOP /2cxx	Long Plain	Psb	Pa	Fw	Pw	Fw	Pk	Pk	Fs	Pk	Ph
LOP /xdxx	Long Plain	Ps	Fa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fhg
LOP /xexx	Long Plain	Pst	Fa	Fw	Pw	Pt	Vsk	Vk	Vst	Vk	Fhg
LLT	Lelant	G	Pa	Pw	Pw	Pw	Vw	Pw	Pw	Vhk	Vh
LLTp	Lelant	G	Pa	Vw	Vwh	Vwa	Vw	Vwh	Vw	Vhk	Vh
LLTd	Lelant	G	Pa	Pw	Pw	Pw	Vw	Pw	Pw	Vkh	Vh
LLTdp	Lelant	G	Pa	Pw	Pw	Pw	Vw	Pw	Pw	Vkh	Vh
LRY /2d2x	Leary	Ps	G	G	Fp	G	Vsk	Vk	Vs	Vka	Gg
LRY /xexx	Leary	Pst	G	G	Ft	Ft	Vsk	Vk	Vs	Vkt	Ftg
LRY /xelx	Leary	Pst	G	G	Ft	Ft	Vsk	Vk	Vs	Vkt	Ftg
LRY /1exx	Leary	Pst	G	G	Ft	Ft	Vsk	Vk	Va	Vka	Ftg
LRY /3exx	Leary	Vb	G	G	Ft	Ft	Vsk	Vk	Vs	Vkt	Ftg
LSL	La Salle	Fis	Va	Fa	Pi	Fia	Pi	Pi	Fs	Pi	Pi
LSL /xcxx	La Salle	Fis	Va	Fa	Pi	Fia	Pi	Pi	Fs	Pi	Pi
LSL /xdxx	La Salle	Fst	Va	Fa	Pi	Fia	Pi	Pi	Fs	Pi	Pi
LSL1	La Salle	Ps	Pa	G	Pi	Fi	Pi	Pi	Fs	Vk	Pi
MFI	Mansfield	Ps	G	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fhg
MFI1 /1cxx	Mansfield	Ps	Fa	Fw	Pw	Fw	Vsk	Vk	Vs	Vk	Fh

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Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
MKY	Mockry	Ps	Ph	Pw	Pw	Pw	Vw	Vk	Vs	Vk	Vh
MRH /xcxx	Marringhurst	Ps	G	G	G	G	Vsk	Vk	Vs	Vk	Gg
NBG	Neuenberg	G	Paq	Faw	Pw	Faw	Pkw	Pk	G	Pk	Fh
NBG /xxxs	Neuenberg	Pn	Paq	Faw	Pw	Faw	Pkw	Pk	G	Pk	Fh
NSH	Narish	Fs	Va	Vh	Vh	Pw	Vw	Vh	Pw	Vh	Vh
NSHp	Narish	G	Va	Vwa	Vw	Pw	Vhw	Vwh	Vw	Vh	Vh
NUH	Neuhorst	Fs	Va	Faw	Pw	Fwa	Pw	Fw	Fs	Fk	Fkh
NUH /xxxs	Neuhorst	Pn	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Fhk
NWN	Newton Siding	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Pk	Fhk
NYO /xcxx	Nayler	Vb	Va	Fa	Fa	Fa	Pk	Pgk	Fs	Pk	G
NYO /xexx	Nayler	Vb	Va	Fa	Fat	Fat	Pk	Pgk	Fst	Vt	Ft
NYO /1exx	Nayler	Vb	Va	Fa	Fat	Fat	Pk	Pgk	Fst	Vt	Ft
NYO /2exx	Nayler	Vb	Va	Fa	Fat	Fat	Pk	Pgk	Fst	Vt	Ft
NYO /xfxx	Nayler	Vt	Va	Fat	Pt	Pt	Pk	Pgk	Pt	Vt	Pt
NYO /1fxx	Nayler	Vt	Va	Fat	Pt	Pt	Pk	Pgk	Pt	Vt	Pt
NYO /2fxx	Nayler	Vt	Va	Fat	Pt	Pt	Pk	Pgk	Pt	Vt	Pt
OAY /xcxx	Oakley	Fs	Va	Fad	Fd	Fa	Pd	Pk	Pd	Pd	Pd
OAY /xdxx	Oakley	Fsb	Va	Fad	Fd	Fa	Vd	Pg	Pd	Pdt	Pd
OAY /1e1x	Oakley	Pt	Va	Fad	Pd	Fat	Vd	Pg	Pd	Vt	Pd
OAY /xfxx	Oakley	Vt	Va	Fad	Pdt	Pt	Vd	Pg	Pdt	Vt	Pdt
OAY /1fxx	Oakley	Vt	Va	Fad	Pdt	Pt	Vd	Pg	Pdt	Vt	Pdt
OBO	Osborne	Ps	Va	Paw	Pw	Paw	Vw	Pw	Psw	G	Vhk
OBO /xxxs	Osborne	Psn	Va	Pwa	Pw	Paw	Vw	Pw	Psw	G	Vhk
OBOp	Osborne	Vw	Va	Vw	Vw	Vw	Vw	Vw	Vsw	G	Vhk
ONH	Onahan	Ps	Fa	Fw	Pw	Fw	Vk	Vk	Fs	Vk	Fh
ONH /xcxx	Onahan	Ps	Fa	Fw	Pw	Fw	Vk	Vk	Fs	Vk	Fh
OWK	Osterwick	G	Pa	Pw	Vw	Pw	Vw	Pkw	Pw	Pkh	Vh
PBI /xcxx	Pembina	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
PBI /1cxx	Pembina	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
PBI /xc1x	Pembina	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
PBI /1c1x	Pembina	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
PBI /2cxx	Pembina	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
PBI /xdxx	Pembina	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
PBI /1dxx	Pembina	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
PBI /1d1x	Pembina	Pb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
PBI /2d1x	Pembina	Vb	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fkt
PBI /1exx	Pembina	Pbt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
PBI /xe1x	Pembina	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
PBI /1e1x	Pembina	Ptb	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
PBI /2exx	Pembina	Pbt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
PBI /2e1x	Pembina	Pbt	Va	Fa	Fat	Fat	Fs	Pt	Fst	Vt	Fkt
PBI /xfxx	Pembina	Vt	Va	Fat	Pt	Pt	Fst	Pt	Pt	Vt	Pt
PBI /1fxx	Pembina	Vt	Va	Fat	Pt	Fat	Fst	Pt	Pt	Vt	Pt
PBI /2fxx	Pembina	Vt	Va	Fat	Pt	Pt	Fst	Pt	Pt	Vt	Pt
PBI1 /xcxx	Pembina	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
PBI1 /1c1x	Pembina	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
PDA	Prodan	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
PDA /xxxs	Prodan	Pn	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Ph
PDA /xcxx	Prodan	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fkt	Ph
PER	Perillo	G	Va	Vaw	Vaw	Vaw	Vsw	Vw	Vsw	Vah	Vh
PER1	Perillo	G	Va	Vaw	Vaw	Vaw	Bsw	Vw	Vsw	Vah	Vh
PLE	Pleasant	G	Va	Fw	Pw	Fw	Pkw	Pk	G	Pk	Ph
PME	Plum Coulee	Ps	Va	Pa	Pwa	Pa	Pws	Fw	Ps	Fah	Phk
PME /xxxs	Plum Coulee	Psn	Va	Pa	Pwa	Pa	Pws	Fw	Ps	Fah	Phk
PME /xdxx	Plum Coulee	Ps	Va	Pa	Pwa	Pa	Pws	Fw	Ps	Pt	Phk
POX	Poolex	G	Va	Pwf	Pw	Pw	Vw	Pw	Pw	Phk	Vh
PPR	Poplar Point	Pb	Va	Faw	Piw	Pif	Vi	Vi	Fs	Vi	Pi
PPR /xcxx	Poplar Point	Pb	Va	Faw	Piw	Pif	Vi	Vi	Fs	Vi	Pi
PPR /xdxx	Poplar Point	Fis	Va	Faw	Piw	Pif	Pi	Pi	Fs	Vi	Pi
PTR	Petrel	G	Pqa	G	Pw	Fw	Pw	Fw	G	Pka	Fh

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
RAM	Ramada	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
RAM /1xxx	Ramada	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
RAM /xcxx	Ramada	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fkt	Fk
RAM /1cxx	Ramada	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Ftk	Fk
RAM /xdxx	Ramada	Fts	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
RAM /1dxx	Ramada	Fst	Va	Fa	Fa	Fa	Fs	G	Fs	Pt	Fk
RAM /xexx	Ramada	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
RAM /1exx	Ramada	Pt	Va	Fa	Fat	Fat	Fs	Ft	Fst	Vt	Fkt
RBK	Rosebank	Ps	Pa	Fw	Pw	Fw	Pw	Fk	Fs	G	Phd
RBK /2xxx	Rosebank	Pbs	Pa	Fw	Pw	Fw	Pw	Pk	Fs	G	Phd
RFD	Reinfeld	G	Va	Fa	Fa	Fa	G	G	G	Fk	Fk
RGD	Rignold	G	Va	Faw	Pwa	Faw	Ps	Fw	G	G	Pdh
RGD /xxxs	Rignold	Pn	Va	Fa	Paw	Faw	Ps	Fw	G	G	Pdh
RLD	Reinland	G	Va	Fwa	Pw	Fwa	Pwk	Pk	G	Pk	Fh
RMP	Rempel	Fs	Va	Fa	Fa	Fa	Fs	G	Fs	Fk	Fk
RSG	Rosengart	G	Va	Fa	Fa	Fa	Pk	Pk	G	Pk	Gg
RWL	Rathwell	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Fhk
RWL /xxxs	Rathwell	Pn	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Fhk
SCK	Stockton	Ps	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /0xxx	Stockton	Ps	Fa	G	G	G	Vks	Vk	Vs	Vk	Gg
SCK /1xxx	Stockton	Ps	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /2xxx	Stockton	Psb	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /xcxx	Stockton	Ps	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /1cxx	Stockton	Ps	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /2cxx	Stockton	Psb	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /xdxx	Stockton	Ps	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /1dxx	Stockton	Ps	Fa	G	G	G	Vsk	Vk	Vs	Vk	Gg
SCK /xexx	Stockton	Vt	Fa	G	Ft	Ft	Vsk	Vk	Vs	Vkt	Ft
SCK /1exx	Stockton	Pst	Fa	G	Ft	Ft	Vsk	Vk	Vs	Vkt	Ft
SEE	Sewell	Ps	Fa	Pw	Pw	Pw	Vw	Pw	Pw	Vkh	Vh

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
SEEp	Sewell	Ps	Ph	Vw	Vw	Pw	Vwh	Vw	Vsw	Vhk	Vh
SEE /xdxx	Sewell	Ps	Fa	Pw	Pw	Pw	Vw	Pw	Pw	Vkh	Vh
SEU /xdxx	Shellmouth	Pb	Va	Fa	Fs	Fa	Pk	Pk	Fa	Pkt	Fk
SEU /xexx	Shellmouth	Pbt	Va	Fa	Fst	Fat	Pk	Pk	Fat	Vt	Fkt
SEU /xfxx	Shellmouth	Vbt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
SEU /1fxx	Shellmouth	Vbt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
SEU /3fxx	Shellmouth	Vbt	Va	Fat	Pt	Pt	Pk	Pkt	Pt	Vt	Pt
SEU /xgxx	Shellmouth	Vbt	Va	Pt	Vt	Vt	Pkt	Vt	Vt	Vt	Vt
SEU /xhxx	Shellmouth	Vbt	Va	Pt	Vt	Vt	Vt	Vt	Vt	Vt	Vt
SHX	Shilox	Vb	G	G	G	G	Vks	Vk	Vs	Vk	Gg
SHX /xcxx	Shilox	Vb	G	G	G	G	Vks	Vk	Vs	Vk	Gg
SHX /xdxx	Shilox	Vb	G	G	G	G	Vks	Vk	Vs	Vk	Gg
SHX /1dxx	Shilox	Vb	G	G	G	G	Vks	Vk	Vs	Vk	Gg
SHX /xexx	Shilox	Vb	G	G	Ft	Ft	Vks	Vk	Vs	Vkt	Ftg
SHX /xfxx	Shilox	Vbt	G	Ft	Pt	Pt	Vks	Vk	Vs	Vkt	Ptg
SHX /2fxx	Shilox	Vbt	G	Ft	Pt	Pt	Vks	Vk	Vs	Vkt	Ptg
SHX /xgxx	Shilox	Vtb	G	Pt	Vt	Vt	Vks	Vkt	Vst	Vkt	Vtg
SKL	Skelding	Vb	G	G	G	G	Vk	Vk	Vs	Vk	Gg
SKL /xcxx	Skelding	Vb	G	G	G	G	Vk	Vk	Vs	Vk	Gg
SKL /xdxx	Skelding	Vb	G	G	G	G	Vk	Vk	Vs	Vk	Gg
SKL /xexx	Skelding	Vb	G	G	Ft	Ft	Vk	Vk	Vs	Vkt	Fgt
SKL /xfxx	Skelding	Vbt	G	Ft	Pt	Pt	Vk	Vk	Vs	Vtk	Ptg
SKL /xhxx	Skelding	Vbt	G	Vt	Vt	Vt	Vkt	Vkt	Vst	Vkt	Vtg
SQR /xxxs	Squirrel Creek	Pn	Va	Faw	Pwa	Pf	Vh	Ph	G	G	Pdh
SUE	St.Claude	Fb	Pa	Faw	Pw	Pf	Vh	Phk	G	Vk	Ph
SUE /xxxs	St.Claude	Pn	Pa	Faw	Pw	Pf	Vh	Phk	G	Vk	Ph
SUE /0xxx	St.Claude	Fb	Pa	Faw	Pw	Pf	Vh	Phk	G	Vk	Ph
TAV /1xxx	Traverse	Fb	Va	Fa	Fa	Fa	G	G	G	Fa	Fk
TDP	Tadpole	Fs	Va	Pw	Pw	Pw	Vw	Pw	Pw	Fa	Vh
TDPp	Tadpole	Vw	Va	Vhw	Vwh	Pw	Vhw	Vhw	Vw	Fa	Vh

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
TGR	Taggart	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Ph
TGR /0xxx	Taggart	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Ph
TLI	Tellier	Fs	Va	Faw	Pw	Faw	Pw	Fw	Fs	Fk	Fk
TLI /xcxx	Tellier	Pb	Va	Faw	Pw	Faw	Ph	Fw	Fs	Fkt	Pkh
TLI /xexx	Tellier	Fst	Va	Faw	Pw	Fat	Pw	Ftw	Fst	Vt	Fkt
TNT /xcxx	Trinton	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
TNT /lclx	Trinton	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
TNT1 /xcxx	Trinton	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
TOC	Torcan	G	Va	Faw	Pw	Faw	Pw	Fw	G	Fak	Ph
VDL	Vandal	Fb	Fq	G	G	G	Vsk	Vk	Fs	Vka	Gg
VDL /xcxx	Vandal	Fs	G	G	G	Fa	Vsk	Vk	Pq	Vka	Gg
VDL /xclx	Vandal	Fb	Fq	G	G	G	Vsk	Vk	Fs	Vka	Gg
VDL /lclx	Vandal	Fb	Fq	G	G	G	Vsk	Vk	Fs	Vka	Gg
VDL /xdxx	Vandal	Pbt	Faq	G	G	G	Vsk	Vk	Pq	Vka	Gg
VDL /ldxx	Vandal	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
VDL /ldlx	Vandal	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
VDL /xexx	Vandal	Pt	Fq	G	Ft	G	Vsk	Vk	Pd	Vka	Ftg
VDL /lexx	Vandal	Pt	Fq	G	Ft	Ft	Vsk	Vk	Pd	Vka	Ftg
VDL /lelx	Vandal	Pt	Fq	G	Ft	Ft	Vsk	Vk	Pd	Vka	Ftg
VDL /xfxx	Vandal	Vt	Fq	Ft	Pt	Pt	Vsk	Vk	Pdt	Vka	Ptg
VDL2	Vandal	Fb	Fq	G	G	G	Vsk	Vk	Pd	Vka	Gg
VDL1 /xcxx	Vandal	Fb	Faq	G	G	Fa	Vsk	Vk	Pd	Vka	Gg
VDL1 /xdxx	Vandal	Ft	Faq	G	G	G	Vsk	Vk	Pd	Vka	Gg
VDL1 /xexx	Vandal	Pt	Faq	G	Ft	Ft	Vsk	Pk	Pd	Vka	Ftg
VTL	Vartel	Fb	Faq	Fwa	Pw	Fwa	Vsk	Vk	Fs	Vka	Fhg
VTL1	Vartel	Fb	Faq	Fwa	Pw	Fwa	Vsk	Vk	Pd	Vka	Ph
VDS	Vordas	C	Va	Pw	Pw	Pw	Vw	Pw	Pw	Vh	Vh
WIK	Winkler	Ps	Va	Pal	Pa	Pa	Ps	Fs	Ps	G	Pk
WIK /xcxx	Winkler	Ps	Va	Pal	Pa	Pa	Ps	G	Ps	Ft	Pk
WIK /xdxx	Winkler	Ps	Va	Pal	Pa	Pa	Ps	G	Ps	Pt	Pk

TABLE 8. SUITABILITY RATINGS OF SOILS FOR SELECTED ENGINEERING USES

Map Symbol and Phase	Soil Name	Top Soil	Sand & Gravel	Road Fill	Permanent Bldgs. With Basements	Local Roads and Streets	Sanitary Trench	Landfill Area	Cover Material	Sewage Lagoons	Septic Fields
WHL	Wheatland	Ps	G	G	G	G	Vsk	Vkg	Pd	Vka	Gg
WHL /xcxx	Wheatland	Ps	G	G	G	G	Vsk	Vkg	Pd	Vka	Gg
WWB	Willowbend	Pw	Va	Pw	Vi	Vi	Viw	Vi	Vw	Vi	Vi
WWB /xcxx	Willowbend	Pw	Va	Pw	Vi	Vi	Viw	Vi	Vw	Vi	Vi
WWC	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /0xxx	Willowcrest	Ps	Paq	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /xxxs	Willowcrest	Psn	Pa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /1xxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /2xxx	Willowcrest	Pbs	Pa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /xcxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /0cxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Pw	Pk	Fs	Vk	Ph
WWC /xdxx	Willowcrest	Ps	Pa	Fw	Pw	Fw	Vs	Vk	Fs	Vk	Ph
WWC /xexx	Willowcrest	Pts	Pa	Fw	Pw	Fwt	Vs	Vk	Fst	Vk	Ph
WWD	Wellwood	Fs	Fq	Fa	G	Fa	Pk	Gg	Fs	Pkg	Fk
WWD /xcxx	Wellwood	Fs	Fq	Fa	G	Fa	Pk	Gg	Fs	Pkg	Fk
WWD /xexx	Wellwood	Pt	Fq	Fa	Ft	Fa	Pk	Ft	Fs	Vt	Fkt
XVI	Xavier	G	Va	Va	Vaw	Vaw	Vsw	Vw	Vsw	Vah	Vh
ZPI /xcxx	Zaplin	Fs	Va	Faw	Pw	Faw	Phw	Fw	Fs	Fk	Fk

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
AIZ /xcxx	Arizona	Vs	Vs	Vs	Vs	G
ASB	Assiniboine	Psk	Ps	Psi	Ps	Pai
ASS	Almasippi	Fsw	Fsw	Fsw	Fw	Fw
ASS /oxxx	Almasippi	Fsw	Fsw	Fsw	Ps	Fw
ASS /xcxx	Almasippi	Fst	Fsw	Fsw	Fw	Fw
ASS /xdxx	Almasippi	Pt	Fsw	Fsw	Fw	Fw
ARN	Aronet	Vs	Pm	Vs	Vs	G
ARN /xdxx	Aronet	Vs	Pm	Vs	Vs	G
ASZ	Agassiz	Pms	Pm	Fs	G	G
ASZ /xc3x	Agassiz	Pms	Pm	Pp	G	Fp
ATN	Altamont	Fs	Fs	Fs	Fs	Fa
ATN /xcxx	Altamont	Fst	Fs	Fs	Fs	Fa
ATN /lcxx	Altamont	Fst	Fs	Fs	Fs	Fa
ATN /lclx	Altamont	Fst	Fs	Fs	Fs	Fa
ATN /xdxx	Altamont	Pt	Fs	Fs	Fs	Fa
ATN /ldxx	Altamont	Pt	Fs	Fs	Fs	Fa
BIP	Bishop	Pws	Ps	Ps	Ps	Pa
BIP /xcxx	Bishop	Pws	Ps	Ps	Ps	Pa
BIP /xcxs	Bishop	Pws	Ps	Ps	Ps	Pa
BKA	Birkenhead	Vs	Pm	Fs	G	G
BKR	Basker	Viw	Vwi	Vwi	Pw	Vh
BMG	Blumengart	Psw	Psw	Psw	Ps	Pa
BNE	Bone	Fw	Fw	Fw	Fw	Faw
BNE /lxxx	Bone	Fw	Fw	Fw	Fw	Faw
BNF	Blumenfeld	Pw	Pw	Pw	Pw	Pw
BNF /xxxs	Blumenfeld	Pw	Pw	Pw	Pw	Pw
BNFp	Blumenfeld	Vsw	Vws	Vsw	Vsw	Pw
BUM	Blumenort	Vw	Vw	Vw	Pw	Vh
CYN	Croyon	Fs	Fsm	Fs	Fs	G
CYN /xcxx	Croyon	Fst	Fsm	Fs	Fs	G
CYN /xdxx	Croyon	Pt	Fsm	Fs	Fs	G
CYN1	Croyon	Fs	Fsm	Fs	Fs	G
CYN1 /xcxx	Croyon	Fst	Fsm	Fs	Fs	G
CYN2	Croyon	Fs	Fsm	Fs	Fs	G
CXT	Capell	Fsw	Fsw	Fsw	Fsw	Fw
CXT1	Capell	Fsw	Fsw	Fsw	Fsw	Fw
CTZ	Chortitz	Pw	Pw	Pw	Fsw	Fw
CXV	Charman	Fsw	Fsw	Fsw	Fsw	Faw
CXV /xdxx	Charman	Pt	Fsw	Fsw	Fsw	Faw
CAV	Carvey	Pw	Pw	Pw	Pw	Pw

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase		Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
CAVl		Carvey	Pw	Pw	Pw	Pw	Pw
CAVp		Carvey	Vws	Vws	Vws	Vs	Vw
CCS		Cactus	Fs	Fsm	Fs	G	G
CKD		Crookdale	Fsw	Fsw	Fsw	Fsw	Fws
DGF	/3d1x	Darlingford	Pt	Fs	Fs	Fs	Fa
DHO		Deadhorse	Ps	Ps	Ps	Ps	Pa
DHO	/xxxs	Deadhorse	Psn	Psn	Psn	Ps	Pa
DHO	/xxxt	Deadhorse	Psn	Psn	Psn	Ps	Pa
DLN		Danlin	Fsw	Fsw	Fsw	Fsw	Faw
DLN	/xdxx	Danlin	Pt	Fsw	Fsw	Fsw	Faw
DGS	/xxxs	Dugas	Psn	Psn	Psn	Ps	Pa
DNH		Denham	G	G	G	G	Fa
DNH	/xdxx	Denham	Pt	G	G	G	Fa
DNH	/1exx	Denham	Vt	Ft	Ft	G	Fat
DOB		Dobbin	Fm	Fm	Fs	G	G
DOB	/xcxx	Dobbin	Fmt	Fm	Fs	G	G
DOB	/xdxx	Dobbin	Pt	Fm	Fs	G	G
DOB	/xexx	Dobbin	Vt	Fmt	Fst	G	Ft
DOB	/xfxx	Dobbin	Vt	Pt	Pt	Ft	Pt
DOB	/1cxx	Dobbin	Fmt	Fm	Fs	G	G
DOB	/1dxx	Dobbin	Pt	Fm	Fs	G	G
DOB	/1xxx	Dobbin	Fm	Fm	Fs	G	G
DOB	/2dxx	Dobbin	Pt	Fm	Fs	G	G
DOT		Dorset	Fsm	Fs	Fs	G	G
DOT	/xcxx	Dorset	Pm	Pm	Fs	G	G
DOT	/xdxx	Dorset	Ptm	Pm	Fs	G	G
DOT	/1cxx	Dorset	Pm	Pm	Fs	G	G
DOT	/1dxx	Dorset	Ptm	Pm	Fs	G	G
DOT	/2cxx	Dorset	Pmq	Vs	Vs	Vs	G
DOT	/2dxx	Dorset	Ptq	Vs	Vs	Vs	G
DRN	/1cxx	Durnan	Fst	Fs	Fs	Fs	Fa
DRN	/xexx	Durnan	Vt	Fst	Fst	Fs	Fat
DXM		Druxman	Fsw	Fsw	Fs	Fsw	Fwa
DXT		Dexter	Fsw	Fsw	Fsw	Fw	Fw
DXT	/xcxx	Dexter	Fst	Fsw	Fsw	Fw	Fw
DZW		Dezwood	Fs	Fs	Fs	Fs	Fa
DZW	/xcxx	Dezwood	Fts	Fs	Fs	Fs	Fa
DZW	/1cxx	Dezwood	Fst	Fs	Fs	Fs	Fa
DZW	/1c1x	Dezwood	Fts	Fs	Fs	Fs	Fa
DZW	/xc1x	Dezwood	Fts	Fs	Fs	Fs	Fa

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
DZW /2cxx	Dezwood	Fts	Fs	Fs	Fs	Fa
DZW /2clx	Dezwood	Fts	Fs	Fs	Fs	Fa
DZW /xdxx	Dezwood	Pt	Fs	Fs	Fs	Fa
DZW /1dxx	Dezwood	Pt	Fs	Fs	Fs	Fa
DZW /2dxx	Dezwood	Pt	Fs	Fs	Fs	Fa
DZW /2d1x	Dezwood	Pt	Fs	Fs	Fs	Fa
DZW /xexx	Dezwood	Vt	Fst	Fts	Fs	Fta
DZW /1exx	Dezwood	Vt	Fst	Fst	Fs	Fat
DZW /2f2x	Dezwood	Vt	Pt	Pt	Fst	Pt
EDK	Edkins	Pw	Pw	Pw	Pw	Pw
EDK /xxxs	Edkins	Pw	Pw	Pw	Pw	Pw
EEK	Elm Creek	Fsw	Fsw	Fsw	Fw	Fw
EEK /1xxx	Elm Creek	Fsw	Fsw	Fsw	Fw	Fw
EEK /xcxx	Elm Creek	Fsw	Fsw	Fsw	Fw	Fw
EGF	Eigenhof	Fs	Fs	Fs	Fs	Fa
EGF /2xxx	Eigenhof	Fs	Fs	Fs	Fs	Fa
EGF /1cxx	Eigenhof	Fst	Fs	Fs	Fs	Fa
EGF /2cxx	Eigenhof	Fst	Fs	Fs	Fs	Fa
EGF /xdxx	Eigenhof	Pt	Fs	Fs	Fs	Fa
EGF /2dxx	Eigenhof	Pt	Fs	Fs	Fs	Fa
EGF /xexx	Eigenhof	Vt	Fst	Fst	Fs	Fat
EGF /2exx	Eigenhof	Vt	Fst	Fst	Fs	Fat
EMV	Elm River	Fis	Fis	Fi	Fis	Pi
EMV /xcxx	Elm River	Fis	Fis	Fi	Fis	Pi
EMV1	Elm River	Fis	Fis	Fi	Fi	Pi
FFR	Fifere	Fs	Fs	Fs	Fs	Fa
FFR /1c1x	Fifere	Fst	Fs	Fs	Fs	Fa
FFR /xdxx	Fifere	Pt	Fs	Fs	Fs	Fa
FFR /1dxx	Fifere	Pt	Fs	Fs	Fs	Fa
FFR /xfxx	Fifere	Vt	Pt	Pt	Fts	Fta
FFR /3f1x	Fifere	Vt	Pt	Pt	Fst	Fta
FIR	Firdale	Fs	Fs	Fs	Fs	Fa
FIR /xcxx	Firdale	Fst	Fs	Fs	Fs	Fa
FIR /1cxx	Firdale	Fst	Fs	Fs	Fs	Fa
FIR /xdxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR /1dxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR /2dxx	Firdale	Pt	Fs	Fs	Fs	Fa
FIR /xexx	Firdale	Vt	Fst	Fst	Fs	Fat
FIR /1exx	Firdale	Vt	Fst	Fst	Fs	Fat
FIR /2exx	Firdale	Vt	Fst	Fst	Fs	Fat

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
FIR /xfxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /1fxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /2fxx	Firdale	Vt	Pt	Pt	Fst	Pt
FIR /xgxx	Firdale	Vt	Vt	Vt	Pt	Vt
FND	Fairland	G	G	G	G	Fa
FND /xcxx	Fairland	Ft	G	G	G	Fa
FND /1cxx	Fairland	Ft	G	G	G	Fa
FND /xdxx	Fairland	Pt	G	G	G	Fa
FND /1dxx	Fairland	Pt	G	G	G	Fa
FND /xexx	Fairland	Vt	Ft	Ft	Ft	Fat
FND /1exx	Fairland	Vt	Ft	Ft	Ft	Fat
FRS	Ferris	Fws	Fws	Fws	Fws	Faw
FRS /xcxx	Ferris	Fsw	Fsw	Fsw	Fsw	Faw
FTN /xx3x	Fortina	Ppw	Pw	Ppw	Pw	Pwp
GBO	Glenboro	G	G	G	G	G
GBO /1xxx	Glenboro	G	G	G	G	G
GBO /xcxx	Glenboro	Ft	G	G	G	G
GBO /2xxx	Glenboro	Fsq	Fs	Fs	G	G
GDH	Gnadenthal	Fw	Fw	Pw	Fw	Fwa
GDH /xxxs	Gnadenthal	Fnw	Fwn	Fwn	Fw	Fwa
GRO	Grover	Fw	Fw	Fw	Fw	Fw
GRR	Guerra	Pw	Pw	Pw	Pw	Pw
GRRp	Guerra	Vws	Vws	Vws	Vs	Vaw
GTD	Gateside	Fw	Fw	Fw	Pw	Faw
GTD /xxxs	Gateside	Fw	Fw	Fw	Fw	Faw
GVS	Gervais	Fsw	Fsw	Fsw	Fsw	Pi
GVS /xcxx	Gervais	Fst	Fsw	Fsw	Fsw	Pi
GVS /xdxx	Gervais	Pt	Fsw	Fsw	Fsw	Pi
GYS	Grayson	Pw	Pw	Pw	Pw	Pw
GYV	Graysville	Fw	Fw	Fw	Fw	Fw
GYV /xxxs	Graysville	Fnw	Fwn	Fwn	Fw	Fw
HAT	Halstead	G	G	G	G	G
HAT /xcxx	Halstead	Ft	G	G	G	G
HAT /1cxx	Halstead	Ft	G	G	G	G
HAT /xdxx	Halstead	Pt	G	G	G	G
HAT /1dxx	Halstead	Pt	G	G	G	G
HAT /xexx	Halstead	Vt	Ft	Ft	G	Fta
HAT /1exx	Halstead	Vt	Ft	Ft	G	Fta
HAT /2exx	Halstead	Vt	Ft	Ft	G	Fta
HAT /xfxx	Halstead	Vt	Pt	Pt	Ft	Pt

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
HAT /1fxx	Halstead	Vt	Pt	Pt	Ft	Pt
HAT /xgxx	Halstead	Vt	Vt	Vt	Ft	Vt
HAT /xhxx	Halstead	Vt	Vt	Vt	Pt	Vt
HEB /1c1x	Hebbot	Fst	Fs	Fsk	Fs	Fa
HIN	Hibsin	Fs	Fs	Fs	G	Fa
HIN /1cxx	Hibsin	Ft	Fs	Fs	G	Fa
HIN /xdxx	Hibsin	Pt	Fs	Fs	G	Fa
HIN /1exx	Hibsin	Vt	Fst	Fst	G	Fa
HHF	Hochfeld	G	G	G	G	Fa
HMO	Hummerston	Fsw	Fsw	Fsw	Fw	Fw
HOS	Horose	Pw	Pw	Pw	Pw	Pw
JIK /xcxx	Janick	Ps	Ps	Ps	Ps	Pa
JIK /xdxx	Janick	Ps	Ps	Ps	Ps	Pa
JST	Jasset	Fw	Fw	Fw	Fw	Faw
JYL	Joyale	Fsw	Fsw	Fsw	Fsw	Faw
KIS /xcxx	Kingsley	Fst	Fs	Fs	Fs	Fa
KIS /xdxx	Kingsley	Pt	Fs	Fs	Fs	Fa
KIS /1dxx	Kingsley	Pt	Fs	Fs	Fs	Fa
KIS /xexx	Kingsley	Vt	Fst	Fst	Fs	Fat
KIS /1exx	Kingsley	Vt	Fst	Fst	Fs	Fat
KIS /2exx	Kingsley	Vt	Fst	Fst	Fs	Fat
KOT	Kronstal	Fw	Fw	Fw	Fw	Faw
KRN	Kerran	Piw	Piw	Piw	Piw	Vi
KUD	Knudson	Fs	Fs	Fs	Fs	Fa
LAY	Layland	Pw	Pw	Pw	Pw	Pw
LEI	Levine	Fis	Fis	Piw	Fsw	Pi
LEW	Loewen	Pi	Pi	Vi	Pi	Pw
LEWp	Loewen	Vis	Vis	Vis	Vis	Vw
LOP	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP /1xxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP /xcxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP /1cxx	Long Plain	Ps	Fsw	Fsw	Ps	Fw
LOP /2cxx	Long Plain	Ps	Ps	Ps	Ps	Pw
LOP /xdxx	Long Plain	Pts	Fsw	Fsw	Ps	Fw
LOP /xexx	Long Plain	Vt	Fwt	Fst	Ps	Fw
LLT	Lelant	Pw	Pw	Pw	Pw	Pw
LLTp	Lelant	Vsw	Vws	Vws	Vws	Va
LLTd	Lelant	Pw	Pw	Pw	Pw	Pw
LLTdp	Lelant	Vs	Vs	Vs	Vs	Va
LRY /2d2x	Leary	Pt	Pm	Fp	G	Fp

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
LRY /xexx	Leary	Vt	Pm	Ft	G	Ft
LRY /xe1x	Leary	Vt	Pm	Ft	G	Ft
LRY /1exx	Leary	Vt	Pm	Ft	G	Ft
LRY /3exx	Leary	Vt	Pm	Ft	G	Ft
LSL	La Salle	Fs	Fs	Fs	Fs	Pi
LSL /xcxx	La Salle	Fst	Fs	Fs	Fs	Pi
LSL /xdxx	La Salle	Vt	Fs	Fs	Fs	Pi
LSL1	La Salle	Ps	Fs	Fs	Fs	Pi
MFI	Mansfield	Vs	Fw	Fw	Fw	Fw
MFI1 /1cxx	Mansfield	Pm	Pm	Fw	Ps	Fw
MKY	Mockry	Pw	Pw	Pw	Pw	Pw
MRH /xcxx	Marringhurst	Pmq	Pm	G	G	G
NBG	Neuenberg	Fw	Fw	Fw	Fw	Faw
NBG /xxxs	Neuenberg	Fwn	Fwn	Fwn	Fw	Faw
NSH	Narish	Pw	Pw	Pw	Pw	Pw
NSHp	Narish	Vws	Vws	Vws	Vws	Vwh
NUH	Neuhorst	Fsw	Fsw	Fsw	Fws	Faw
NUH /xxxs	Neuhorst	Fsw	Fsw	Fsw	Fws	Faw
NWN	Newton Siding	Fsw	Fsw	Fsw	Fws	Faw
NYO /xcxx	Nayler	Fst	Fs	Fs	Fs	Fa
NYO /xexx	Nayler	Vt	Fst	Fst	Fs	Fat
NYO /1exx	Nayler	Vt	Fst	Fst	Fs	Fat
NYO /2exx	Nayler	Vt	Fst	Fst	Fs	Fat
NYO /xfxx	Nayler	Vt	Pt	Pt	Fst	Pt
NYO /1fxx	Nayler	Vt	Pt	Pt	Fst	Pt
NYO /2fxx	Nayler	Vt	Pt	Pt	Fst	Pt
OAY /xcxx	Oakley	Fst	Fs	Fs	Fs	Fa
OAY /xdxx	Oakley	Pt	Fs	Fs	Fs	Fa
OAY /1e1x	Oakley	Vt	Fst	Fst	Fs	Fd
OAY /xfxx	Oakley	Vt	Pt	Pt	Fst	Pt
OAY /1fxx	Oakley	Vt	Pt	Pt	Fst	Pt
OBO	Osborne	Psw	Psw	Psw	Psw	Paw
OBO /xxxs	Osborne	Psw	Pws	Psw	Pws	Paw
OBOp	Osborne	Vws	Vws	Vws	Vws	Vw
ONH	Onahan	Vs	Vs	Vs	Vs	Fw
ONH /xcxx	Onahan	Vs	Vs	Vs	Vs	Fw
OWK	Osterwick	Pw	Pw	Pw	Pw	Pw
PBI /xcxx	Pembina	Fst	Fs	Fs	Fs	Fa
PBI /1cxx	Pembina	Fst	Fs	Fs	Fs	Fa
PBI /xc1x	Pembina	Fst	Fs	Fs	Fs	Fa

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
PBI /1c1x	Pembina	Fst	Fs	Fs	Fs	Fa
PBI /2cxx	Pembina	Fst	Fs	Fs	Fs	Fa
PBI /xdxx	Pembina	Pt	Fs	Fs	Fs	Fa
PBI /1dxx	Pembina	Pt	Fs	Fs	Fs	Fa
PBI /1d1x	Pembina	Pt	Fs	Fs	Fs	Fa
PBI /2d1x	Pembina	Pt	Fs	Fs	Fs	Fa
PBI /1exx	Pembina	Vt	Fst	Fst	Fs	Fat
PBI /xe1x	Pembina	Vt	Fst	Fst	Fs	Fat
PBI /1e1x	Pembina	Vt	Fst	Fst	Fs	Fat
PBI /2exx	Pembina	Vt	Fst	Fst	Fs	Fat
PBI /2e1x	Pembina	Vt	Fst	Fst	Fs	Fat
PBI /xfxx	Pembina	Vt	Pt	Pt	Fst	Pt
PBI /1fxx	Pembina	Vt	Pt	Pt	Ps	Pt
PBI /2fxx	Pembina	Vt	Pt	Pt	Fst	Pt
PBI1 /xcxx	Pembina	Fst	Fs	Fs	Fs	Fa
PBI1 /1c1x	Pembina	Fst	Fs	Fs	Fs	Fa
PDA	Prodan	Fsw	Fsw	Fsw	Fsw	Faw
PDA /xxxs	Prodan	Fwn	Fwn	Fwn	Fsw	Faw
PDA /xcxx	Prodan	Fst	Fsw	Fsw	Fsw	Faw
PER	Perillo	Vsw	Vsw	Vsw	Vsw	Va
PER1	Perillo	Vsw	Vsw	Vsw	Vsw	Va
PLE	Pleasant	Fw	Fw	Fw	Fw	Fw
PME	Plum Coulee	Ps	Ps	Ps	Ps	Pa
PME /xxxs	Plum Coulee	Ps	Ps	Ps	Ps	Pa
PME /xdxx	Plum Coulee	Pst	Ps	Ps	Ps	Pa
POX	Poolex	Pw	Pw	Pw	Pw	Pw
PPR	Poplar Point	Fsw	Fsw	Fsw	Fsw	Piw
PPR /xcxx	Poplar Point	Fst	Fsw	Fsw	Fsw	Piw
PPR /xdxx	Poplar Point	Pt	Fsw	Fsw	Fsw	Pi
PTR	Petrel	Fw	Fw	Fw	Fw	Fw
RAM	Ramada	Fs	Fs	Fs	Fs	Fa
RAM /1xxx	Ramada	Fs	Fs	Fs	Fs	Fa
RAM /xcxx	Ramada	Fst	Fs	Fs	Fs	Fa
RAM /1cxx	Ramada	Fst	Fs	Fs	Fs	Fa
RAM /xdxx	Ramada	Pt	Fs	Fs	Fs	Fa
RAM /1dxx	Ramada	Pt	Fs	Fs	Fs	Fa
RAM /xexx	Ramada	Vt	Fst	Fst	Fs	Fat
RAM /1exx	Ramada	Vt	Fst	Fst	Fs	Fat
RBK	Rosebank	Fw	Fw	Fw	Fw	Fw
RBK /2xxx	Rosebank	Fw	Fw	Fw	Fw	Fw

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase		Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
RFD		Reinfeld	G	G	G	G	Fa
RGD		Rignold	Fw	Fw	Fw	Fw	Fa
RGD	/xxxs	Rignold	Fwn	Fwn	Fwn	Fw	Fa
RLD		Reinland	Fw	Fw	Fw	Fw	Fw
RMP		Rempel	Fs	Fs	Fs	Fs	Fa
RSG		Rosengart	G	G	G	G	Fa
RWL		Rathwell	Fsw	Fsw	Fsw	Fsw	Faw
RWL	/xxxs	Rathwell	Fnw	Fnw	Fnw	Fnw	Faw
SCK		Stockton	Fs	Fs	Fs	G	G
SCK	/0xxx	Stockton	Fs	Fs	Fs	G	G
SCK	/1xxx	Stockton	Fs	Fs	Fs	G	G
SCK	/2xxx	Stockton	Vs	Vs	Vs	Vs	G
SCK	/xcxx	Stockton	Fst	Fs	Fs	G	G
SCK	/1cxx	Stockton	Fts	Fs	Fs	Fs	G
SCK	/2cxx	Stockton	Ft	Vs	Vs	Vs	G
SCK	/xdxx	Stockton	Pt	Fs	Fs	G	G
SCK	/1dxx	Stockton	Pt	Fs	Fs	Fs	G
SCK	/xexx	Stockton	Vt	Fsm	Fsm	G	Ft
SCK	/1exx	Stockton	Vt	Fs	Fs	G	Ft
SEE		Sewell	Pw	Pw	Pw	Pw	Pw
SEEp		Sewell	Vsw	Vsw	Vsw	Vs	Vah
SEE	/xdxx	Sewell	Pw	Pw	Pw	Pw	Pw
SEU	/xdxx	Shellmouth	Pt	Fs	Fs	Fs	Fa
SEU	/xexx	Shellmouth	Vt	Fst	Fst	Fs	Fat
SEU	/xfxx	Shellmouth	Vt	Pt	Pt	Fst	Pt
SEU	/1fxx	Shellmouth	Vt	Pt	Pt	Fst	Pt
SEU	/3fxx	Shellmouth	Vt	Pt	Pt	Fst	Pt
SEU	/xgxx	Shellmouth	Vt	Vt	Vt	Pt	Vt
SEU	/xhxx	Shellmouth	Vt	Vt	Vt	Vt	Vt
SHX		Shilox	Vs	Vs	Vs	Vs	G
SHX	/xcxx	Shilox	Vs	Vs	Vs	Vs	G
SHX	/xdxx	Shilox	Vs	Vs	Vs	Ps	G
SHX	/1dxx	Shilox	Vs	Vs	Vs	Ps	G
SHX	/xexx	Shilox	Vts	Vs	Vs	Ps	Ft
SHX	/xfxx	Shilox	Vts	Vs	Vs	Ps	Pt
SHX	/2fxx	Shilox	Vts	Vs	Vs	Vs	Pt
SHX	/xgxx	Shilox	Vts	Vts	Vts	Vs	Vt
SKL		Skelding	Vs	Vs	Vs	Vs	G
SKL	/xcxx	Skelding	Vs	Vs	Vs	Vs	G
SKL	/xdxx	Skelding	Vst	Vs	Vs	Vs	G

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase	Soil Name	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
SKL /xexx	Skelding	Vts	Vs	Vs	Vs	Ft
SKL /xfxx	Skelding	Vst	Vs	Vs	Vs	Pt
SKL /xhxx	Skelding	Vst	Vts	Vt	Vs	Vt
SQR /xxxs	Squirrel Creek	Pw	Pw	Pw	Faw	Pf
SUE	St.Claude	Pw	Pw	Pw	Fsw	Pf
SUE /xxxs	St.Claude	Pw	Pw	Pw	Fsw	Pf
SUE /0xxx	St.Claude	Pw	Pw	Pw	Fsw	Pf
TAV /1xxx	Traverse	G	G	G	G	Fa
TDP	Tadpole	Pw	Pw	Pw	Pw	Pw
TDPp	Tadpole	Vw	Vw	Vw	Pw	Pw
TGR	Taggart	Fsw	Fsw	Fsw	Fsw	Faw
TGR /0xxx	Taggart	Fsw	Fsw	Fsw	Fsw	Faw
TLI	Tellier	Fsw	Fsw	Fsw	Fsw	Faw
TLI /xcxx	Tellier	Fsw	Fsw	Fsw	Fsw	Faw
TLI /xexx	Tellier	Vt	Fst	Fsw	Fsw	Fat
TNT /xcxx	Trinton	Fst	Fsm	Fs	Fs	Fa
TNT /1c1x	Trinton	Fst	Fsm	Fs	Fs	Fa
TNT1 /xcxx	Trinton	Fst	Fsm	Fs	Fs	Fa
TOC	Torcan	Fsw	Fsw	Fsw	Fsw	Faw
VDL	Vandal	Pq	Fsm	Fs	Fs	G
VDL /xcxx	Vandal	Gs	Fsm	Fs	Fs	G
VDL /xc1x	Vandal	Pq	Fsm	Fs	Fs	G
VDL /1c1x	Vandal	Pq	Fsm	Fs	Fs	G
VDL /xdxx	Vandal	Pqt	Fsm	Fs	Fs	G
VDL /1dxx	Vandal	Pqt	Fsm	Fs	Fs	G
VDL /1d1x	Vandal	Pqt	Fsm	Fs	Fs	G
VDL /xexx	Vandal	Vt	Fst	Fst	Fs	Ft
VDL /1exx	Vandal	Vt	Fst	Fst	Fs	Pt
VDL /1e1x	Vandal	Vt	Fst	Fst	Fs	Ft
VDL /xfxx	Vandal	Vt	Pt	Pt	Fst	Pt
VDL2	Vandal	Pq	Fsm	Fs	Fs	G
VDL1 /xcxx	Vandal	Pq	Fsm	Fs	Fs	G
VDL1 /xdxx	Vandal	Pqt	Fsm	Fs	Fs	G
VDL1 /xexx	Vandal	Vt	Fsm	Fst	Fs	Ft
VTL	Vartel	Fsw	Fws	Fws	Fsw	Fw
VTL1	Vartel	Fsw	Fsw	Fsw	Fsw	Fw
VDS	Vordas	Pw	Pw	Pw	Pw	Pw
WIK	Winkler	Ps	Ps	Ps	Ps	Pa
WIK /xcxx	Winkler	Ps	Ps	Ps	Ps	Pa
WIK /xdxx	Winkler	Pst	Ps	Ps	Ps	Pa

TABLE 9. SUITABILITY RATINGS OF SOILS FOR RECREATIONAL USES

Map Symbol and Phase		*Soil Name*	Play Ground	Picnic Area	Camp Area	Path And Trails	Permanent Bldgs. Without Basements
WHL		Wheatland	Fs	Fs	Fs	G	G
WHL	/xcxx	Wheatland	Fs	Fs	Fs	G	G
WWB		Willowbend	Viw	Viw	Viw	Viw	Vi
WWB	/xcxx	Willowbend	Viw	Viw	Viw	Viw	Vi
WWC		Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC	/0xxx	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC	/xxxs	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC	/1xxx	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC	/2xxx	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC	/xcxx	Willowcrest	Fwt	Fsw	Fsw	Fw	Fw
WWC	/0cxx	Willowcrest	Fsw	Fsw	Fsw	Fw	Fw
WWC	/xdxx	Willowcrest	Pt	Fsw	Fsw	Fw	Fw
WWC	/xexx	Willowcrest	Vt	Fst	Fst	Fw	Fwt
WWD		Wellwood	Fs	Fs	Fs	Fs	Fa
WWD	/xcxx	Wellwood	Fst	Fs	Fs	Fs	Fa
WWD	/xexx	Wellwood	Vt	Fst	Fst	Fs	Fta
XVI		Xavier	Vsw	Vsw	Vsw	Vsw	Vaw
ZPI	/xcxx	Zaplin	Fsw	Fsw	Fsw	Fsw	Faw

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Appendix A

GLOSSARY

AASHO classification (soil engineering) - The official classification of soil materials and soil aggregate mixtures for highway construction used by the American Association of State Highway Officials.

Acid soil - A soil having a pH less than 7. See pH and Reaction, soil.

Alkaline soil - A soil having a pH greater than 7. See Reaction, soil.

Alluvium - A general term for all deposits of rivers and streams.

Arable soil - Soil suitable for plowing and cultivation.

Association - A sequence of soils of about the same age, derived from similar parent material, and occuring under similar climatic conditions but showing different characteristics due to variations in relief and in drainage.

1/3 Atmosphere Moisture - The moisture percentage on dry weight basis of a soil sample that has been air dried, screened, saturated and subjected to a soil moisture tension of 345 cm of water through a permeable membrane for a period of 48 hours. It approximates the soil moisture retention capacity.

Available nutrient - That portion of any element or compound in the soil that can be readily absorbed and assimilated by growing plants.

Available soil moisture - The portion of water in a soil that can be readily absorbed by plant roots: generally considered to be that water held in the soil up to approximately 15 atmospheres pressure.

Bearing capacity - Capacity of soil (in moist to wet conditions) to support loads such as buildings, people, vehicles, and animals.

Bedrock - The solid rock that underlies soil and regolith or that is exposed at the surface.

Boulders - Stones which are larger than 60 cm in diameter.

Bulk density - The weight of oven dry soil (105 degrees C) divided by its volume at field moisture conditions, expressed in grams per cubic centimeter.

Buried soil - Soil covered by an alluvial, loessial, or other deposit, usually to a depth greater than the thickness of the solum.

Calcareous soil - Soil containing sufficient calcium carbonate (often with magnesium carbonate) to effervesce visibly when treated with hydrochloric acid.

Calcium Carbonate Equivalent - Refers to the percent of carbonates in the soil expressed on the basis of calcium carbonate. Terms used to express the carbonate contents of soils are:

noncalcareous	<1%
weakly calcareous	1-5%
moderately calcareous	6-15%
strongly calcareous	16-25%
v. strongly calcareous	26-40%
extremely calcareous	>40%

Capillary fringe - A zone of essentially saturated soil just above the water table. The size distribution of the pores determines the extent and degree of the capillary fringe.

Carbon-nitrogen ratio (C/N ratio) - The ratio of the weight of organic carbon to the weight of total nitrogen in a soil or in an organic material.

Cation Exchange Capacity (**CEC**) - A measure of the total amount of exchangeable cations that can be held by a soil. Expressed in milliequivalents per 100g of soil.

Clay - As a soil separate, the mineral soil particles less than 0.002 mm in diameter: usually consisting largely of clay minerals. As a soil textural class, soil materials that contain 40 or more percent clay, less than 45 percent sand and less than 40 percent silt.

Cobbles - Rock fragments 8 to 25 cm in diameter.

Color - Soil colors are compared with a Munsell color chart. The Munsell system specifies the relative degrees of the three simple variables of color: hue, value and chroma. For example: 10YR 6/4 means a hue of 10YR, a value of 6, and a chroma of 4.

Complex (**soil**) - A mapping unit used in detailed and reconnaissance soil surveys where two or more soil series that are so intimately intermixed in an area that it is impractical to separate them at the scale of mapping used.

Concretions - Hard grains, pellets or nodules from concentration of compounds in the soil that cement soil grains together.

Conductivity, electrical - A physical quantity that measures the readiness with which a medium (irrigation water and soil extracts) transmits electricity. It expresses the concentration of salt in terms of the conductance (reciprocal of the electric resistance in ohms) in millisiemens per cm.

Consistence (**soil**) - The mutual attraction of the particles in a soil mass, or their resistence to separation or deformation. It is described in terms such as loose, soft, friable, firm, hard, sticky, plastic or cemented.

Consumptive use factor (**CU**) - The ratio of consumptive use of water by a crop to potential evapotranspiration. and transpiration. An actively growing crop that completely covers the soil over a large area and that has an ample supply of readily available soil water has a consumptive use factor of 1.0.

Consumptive use of water - The sum of the depths of water transpired by the plants and evaporated from the soil surface and from intercepted precipitation. It may be less or greater than potential evapotranspiration.

Contour - An imaginary line connecting points of equal elevation on the surface of the soil.

Cover - This term generally has one of the following meanings:

1. Vegetation or other material providing protection
2. In forestry, low growing shrubs and herbaceous plants under trees (i.e., ground cover vs. tree cover)
3. Any vegetation producing a protective mat on or just above the soil surface.

Creep (soil) - Slow mass movement of soil and soil material down rather steep slopes primarily under the influence of gravity, but aided by saturation with water and by alternate freezing and thawing.

Decile portion - A one-tenth portion. As used in the soil map symbol A7-B3 means that the A soils cover seven tenths and the B soils cover three tenths of the map unit.

Delta - A fluvial or glaciofluvial fan shaped deposit at the mouth of a river that empties into a lake or sea.

Deflocculate - To separate or to break up soil aggregates into individual particles by chemical or physical means or both.

Degradation (of soils) - The changing of a soil to a more highly leached and more highly weathered condition, usually accompanied by morphological changes such as the development of an eluviated light colored (Ae) horizon.

Dispersion - Is rated high, moderate or low depending on how readily the soil structure breaks down or slakes because of excess moisture. A rating of high indicates that soil aggregates slake readily; a rating of low indicates that aggregates are resistant to dispersion and remain clumped together.

Drainage (soil) - (1) The rapidity and extent of the removal of water from the soil by runoff and flow through the soil to underground spaces. (2) As a condition of the soil, it refers to the frequency and duration of periods when the soil is free of saturation.

Drainage in soil reports is described on the basis of actual moisture content in excess of field capacity and length of the saturation period within the plant root zone. The terms are as follows:

Very rapidly drained - Water is removed from the soil very rapidly in relation to supply. Excess water flows downward very rapidly if underlying material is pervious. There may be very rapid subsurface flow during heavy rainfall provided there is a steep gradient. Soils have very low available water storage capacity (usually less than 2.5 cm) within the control section and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Rapidly drained - Water is removed from the soil rapidly in relation to supply. Excess water flows downward if underlying material is pervious. Subsurface flow may occur on steep gradients during heavy rainfall. Soils have low available water storage capacity (2.5-4 cm) within the control section, and are usually coarse in texture, or shallow, or both. Water source is precipitation.

Well drained - Water is removed from the soil readily but not rapidly. Excess water flows downward readily into underlying pervious material or laterally as subsurface flow. Soils have intermediate available water storage capacity (4-5 cm) within the control section, and are generally intermediate in texture and depth. Water source is precipitation. On slopes subsurface flow may occur for short durations but additions are equaled by losses. These soils are usually free of mottles within 100 cm of the surface but may be mottled below this depth. Soil horizons are usually bright colored.

Moderately well drained - Water is removed from the soil somewhat slowly in relation to supply. Excess water is removed somewhat slowly due to low perviousness, shallow water table, lack of gradient, or some combination of these. Soils have intermediate to high water storage capacity (5-6cm) within the control section and are usually medium to fine in texture. Soils are commonly mottled in the 50 to 100 cm depth. Colors are dull brown in the subsoil with stains and mottles.

Imperfectly drained - Water is removed from the soil sufficiently slowly in relation to supply to keep the soil wet for a significant part of the growing season. Excess water moves slowly downward if precipitation is major supply. If subsurface water or groundwater, or both, is the main source, flow rate may vary but the soil remains wet for a significant part of the growing season. Precipitation is the main source if available water storage capacity is high; contribution by subsurface flow or groundwater flow, or both, increases as available water storage capacity decreases. Soils have a wide range in available water supply, texture, and depth, and are gleyed phases of well drained subgroups. These soils generally have mottling below the surface layers and generally have duller colors with depth, generally brownish gray with mottles of yellow and gray.

Poorly drained - Water is removed so slowly in relation to supply that the soil remains wet for a comparatively large part of the time the soil is not frozen. Excess water is evident in the soil for a large part of the time. Subsurface flow or groundwater flow, or both, in addition to precipitation are main water sources; there may also be a perched water table, with precipitation exceeding evapotranspiration. Poorly drained soils have a wide range in available water storage capacity, texture, and depth, and are gleyed subgroups, Gleysols, and Organic soils.

Very poorly drained - Water is removed from the soil so slowly that the water table remains at or on the surface for the greater part of the time the soil is not frozen. Excess water is present in the soil for the greater part of the time. Groundwater flow and subsurface flow are major water sources. Precipitation is less important except where there is a perched water table with precipitation exceeding evapotranspiration. These soils have a wide range in available water storage capacity, texture, and depth, and are either Gleysolic or Organic.

Dryland farming - The practice of crop production in low rainfall areas without irrigation.

Eluvial horizon - A horizon from which material has been removed in solution or in water suspension.

Eolian - Soil material accumulated through wind action.

Erosion - The wearing away of the land surface by detachment and transport of soil and rock material through the action of moving water, wind or other geological processes. The ratings of erosion are:

Erosion 1	slightly eroded - soil with a sufficient amount of the A horizon removed that ordinary tillage will bring up and mix the B horizon or other lower lying horizons with surface soil in the plow layer.
Erosion 2	moderately eroded - soil with all of the A horizon and a part of the B or other lower lying horizons removed. The plow layer consists mainly of the original horizons below the A or below the original plow layer.
Erosion 3	severely eroded - soils have practically all of the original surface soil removed. The plow layer consists mainly of C horizon material, especially on knolls and steep upper slope positions.

Evapotranspiration - The combined loss of water from a given area, and during a specific period of time, by evaporation from the soil surface and transpiration from plants.

Field Moisture Equivalent - The minimum moisture content at which a drop of water placed on a smoothed surface of the soil will not be absorbed immediately by the soil, but will spread out over the surface and give it a shiny appearance.

Flood plain - The land bordering a stream, built up of sediments from overflow of the stream and subject to inundation when the stream is at flood stage.

Fluvial deposits - All sediments past and present, deposited by flowing water, including glaciofluvial deposits.

Frost heave - The raising of the surface caused by ice in the subsoil.

Friable - Soil aggregates that are soft and easily crushed between thumb and forefinger.

Glaciofluvial deposits - Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. These deposits are stratified and may occur in the form of outwash plains, deltas, kames, eskers and kame terraces.

Gleyed soil - An imperfectly or poorly drained soil in which the material has been modified by reduction or alternating reduction and oxidation. These soils have lower chromas or more prominent mottling or both in some horizons than the associated well-drained soil.

Gleysolic - An order of soils developed under wet conditions and permanent or periodic reduction. These soils have low chromas or prominent mottling or both, in some horizons.

Gravel - Rock fragments 2 mm to 7.5 cm in diameter.

Ground Moraine - An unsorted mixture of rocks, boulders, sand, silt and clay deposited by glacial ice. The predominant material is till; most till is thought to have accumulated under the ice by lodgment, but some till has been let down from the upper surface of the ice by ablation. Resorting and modification may have taken place to some extent by wave-action of glacial melt waters. The topography is most commonly in the form of undulating plains with gently sloping hills and enclosed depressions.

Groundwater - Water beneath the soil surface, usually under conditions where the voids are completely filled with water (saturation).

Halophytic vegetation - vegetation that grows naturally in soils having a high content of various salts. It usually has fleshy leaves or thorns and resembles desert vegetation.

Horizon (soil) - A layer in the soil profile approximately parallel to the land surface with more or less well-defined characteristics that have been produced through the operation of soil forming processes.

Horizon boundary - The lower boundary of each horizon is described by indicating its distinctness and form. The distinctness depends on the abruptness of vertical change (thickness). The form refers to the variation of the boundary plane.

Distinctness -
abrupt - less than 2 cm
clear - 2 to 5 cm
gradual - 5 to 15 cm
diffuse - more than 15 cm

Form -
smooth - nearly plain
wavy - pockets are wider than deep
irregular - pockets are deeper than wide
broken - parts of the horizon are unconnected with other parts

Humic layer - A layer of highly decomposed organic soil material containing little fibre.

Hydraulic Conductivity - Refers to the effective flow velocity or discharge velocity in soil at unit hydraulic gradient. It is an approximation of the permeability of the soil and is expressed in cm per hour. The classes are described in general or specific terms as:

High	>15	Very rapid	>50
		Rapid	15-50
Medium	0.5-15	Mod. rapid	5.0-15
		Moderate	1.5-5.0
		Mod. slow	0.5-1.5
Low	<0.5	Slow	0.15-0.5
		Very slow	0.015-0.15
		Extremely slow	<.015

Hydrologic cycle - The conditions through which water naturally passes from the time of precipitation until it is returned to the atmosphere by evaporation and is again ready to be precipitated.

Hydrophyte - Plants growing in water or dependent upon wet or saturated soil conditions for growth.

Illuvial horizon - A soil horizon in which material carried from an overlying layer has been precipitated from solution or deposited from suspension. The layer of accumulation.

Impeded drainage - A condition that hinders the movement of water by gravity through the soils.

Inclusion - Soil type found within a mapping unit that is not extensive enough to be mapped separately or as part of a complex.

Infiltration - The downward entry of water into the soil

Irrigation - The artificial application of water to the soil for the benefit of growing crops.

Irrigation requirement (IR) - Refers to the amount of water exclusive of effective precipitation that is required for crop production.

Lacustrine deposits - Material deposited by or settled out of lake waters and exposed by lowering of the water levels or elevation of the land. These sediments range in texture from sand to clay and are usually varved (layered annual deposits).

Landforms - See Description of Landforms

Landscape - All the natural features such as fields, hills, forest, water, etc., which distinquish one part of the earth's surface from another part.

Leaching - The removal from the soil of materials in solution.

Liquid limit (upper plastic limit) - The water content corresponding to an arbitrary limit between the liquid and plastic states of consistency of a soil. The water content at this boundary is defined as that at which a pat of soil cut by a groove of standard dimensions will flow together for a distance of 1.25 cm under the impact of 25 blows in a standard liquid limit apparatus.

Lineal shrinkage - This is the decrease in one dimension expressed as a percentage of the original dimension of the soil mass when the moisture content is reduced from a stipulated percentage (usually field moisture equivalent) to the shrinkage limit.

Mapping Unit - Any delineated area shown on a soil map that is identified by a symbol. A mapping unit may be a soil unit, a miscellaneous land type, or a soil complex.

Marsh - Periodically flooded or continually wet areas having the surface not deeply submerged. It is covered dominantly with sedges, cattails, rushes or other hydrophytic plants.

Mature soil - A soil having well-developed soil horizons produced by the natural processes of soil formation.

Mesophyte - Plants requiring intermediate moisture conditions and are not very resistant to drought.

Microrelief - Small-scale, local differences in relief including mounds, swales or hollows.

Milliequivalent (me) - One-thousandth of an equivalent. An equivalent is the weight in grams of an ion or compound that combines with or replaces one gram of hydrogen. The atomic or formula weight divided by valence.

Mottles - Irregularly marked spots or streaks, usually yellow or orange but sometimes blue. They are described in order of abundance (few, common, many), size (fine, medium, coarse) and contrast (faint, distinct, prominent). Mottles in soils indicate poor aeration and lack of good drainage.

Organic carbon - Carbon derived from plant and animal residues.

Organic matter - The fraction of the soil which consists of plant and animal residues at various stages of decomposition, cells and tissues of soil organisms and substances synthesized by the soil population. It is determined on soils that have been sieved through a 2.0 mm sieve. It is estimated by multiplying the organic carbon by a factor of 1.72.

Outwash - Sediments "washed out" beyond the glacier by flowing water and laid down in thin beds or strata. Particle size may range from boulders to silt.

Ovendry soil - Soil that has been dried at 105 degrees C until it has reached constant weight.

Parent material - The unaltered or essentially unaltered mineral or organic material from which the soil profile develops by pedogenic processes.

Particle size, soil - The grain size distribution of the whole soil including the coarse fraction. It differs from texture, which refers to the fine earth (less than 2mm) fraction only. In addition, textural classes are usually assigned to specific horizons whereas soil family particle-size classes indicate a composite particle size of a part of the control section that may include several horizons. See Textural Triangle at end of Glossary.

The particle-size classes for family groupings are as follows:

Fragmental Stones, cobbles and gravel, with too little fine earth to fill interstices larger than 1 mm.

Sandy-skeletal Particles coarser than 2 mm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the sandy particle-size class.

Loamy-skeletal Particles 2 mm-25 cm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the loamy particle-size class.

Clayey-skeletal Particles 2 mm-25 cm occupy 35% or more by volume with enough fine earth to fill interstices larger than 1 mm; the fraction finer than 2 mm is that defined for the clayey particle-size class.

Sandy The texture of the fine earth includes sands and loamy sands, exclusive of loamy very fine sand and very fine sand textures; particles 2 mm- 25 cm occupy less than 35% by volume.

Loamy The texture of the fine earth includes loamy very fine sand, very fine sand, and finer textures with less than 35% clay; particles 2 mm-25 cm occupy less than 35% by volume.

Coarse-loamy. A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-loamy. A loamy particle size that has 15% or more by weight of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

Coarse-silty. A loamy particle size that has less than 15% of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has less than 18% clay in the fine earth fraction.

Fine-silty. A loamy particle size that has less than 15% of fine sand (0.25-0.1 mm) or coarser particles, including fragments up to 7.5 cm, and has 18-35% clay in the fine earth fraction.

Clayey. The fine earth contains 35% or more clay by weight and particles 2mm-25 cm occupy less than 35% by volume.

Fine-clayey. A clayey particle size that has 35-60% clay in the fine earth fraction.

Very-fine-clayey. A clayey particle size that has 60% or more clay in the fine earth fraction.

Ped - An individual soil aggregate such as granule, prism or block formed by natural processes (in contrast with a clod which is formed artificially).

Pedology - Those aspects of soil science involving constitution, distribution, genesis and classification of soils.

Percolation - The downward movement of water through soil; specifically, the downward flow of water in saturated or nearly saturated soil at hydraulic gradients of 1.0 or less.

Permafrost -

1. Perennially frozen material underlying the solum.

2. A perennially frozen soil horizon.

Permafrost table - The upper boundary of permafrost, usually coincident with the lower limit of seasonal thaw (active layer).

Permeability - The ease with which water and air pass through the soil to all parts of the profile. See hydraulic conductivity.

pH - The intensity of acidity and alkalinity, expressed as the negative logarithm of the hydrogen ion concentration. A pH of 7 is neutral, lower values indicate acidity and higher values alkalinity (see Reaction, soil).

Phase, soil - A soil phase is used to characterize soil and landscape properties that are not used as criteria in soil taxonomy. The major phase differentiae are: slope, erosion, deposition, stoniness, texture, salinity, and calcareousness.

Plastic Limit - The water content corresponding to an arbitrary limit between the plastic and the semisolid states of consistency of a soil.

Plasticity Index - The numerical difference between the liquid and the plastic limit. The plasticity index gives the range of moisture contents within which a soil exhibits plastic properties.

Potential evapotranspiration (PE) - The maximum quantity of water capable of being lost as water vapor, in a given climate, by a continuous stretch of vegetation covering the whole ground and well supplied with water.

Profile, soil - A vertical section of the soil through all its horizons and extending into the parent material.

Reaction, soil - The acidity or alkalinity of a soil. Soil reaction classes are characterized as follows:

extremely acid	pH <4.5
very strongly acid	4.5 to 5.0
strongly acid	5.1 to 5.5
medium acid	5.6 to 6.0
slightly acid	6.1 to 6.5
neutral	6.6 to 7.3
mildly alkaline	7.4 to 7.8
mod. alkaline	7.9 to 8.4
strongly alkaline	8.5 to 9.0
very strongly alkaline	>9.0

Regolith - The unconsolidated mantle of weathered rock and soil material on the earth's surface.

Relief - The elevation of inequalities of the land surface when considered collectively.

Runoff - The portion of the total precipitation on an area that flows away through stream channels. Surface runoff does not enter the soil. Groundwater runoff or seepage flow from groundwater enters the soil before reaching the stream.

Saline Soil - A nonalkali soil containing soluble salts in such quantities that they interfere with the growth of most crop plants. The conductivity of the saturation extract is greater than 4 millisiemens/cm (ms/cm), the exchangeable-sodium percentage is less than 15, and the pH is usually less than 8.5. Approximate limits of salinity classes are:

non-saline	0 to 4 ms/cm
weakly saline	4 to 8 mS/cm
mod. saline	8 to 15 ms/cm
strongly saline	>15 ms/cm

Salinization - The process of accumulation of salts in the soil.

Salt-Affected Soil - Soil that has been adversely modified for the growth of most crop plants by the presence of certain types of exchangeable ions or of soluble salts. It includes soils having an excess of salts, or an excess of exchangeable sodium or both.

Sand - A soil particle between 0.05 and 2.0 mm in diameter. The textural class name for any soil containing 85 percent or more of sand and not more than 10 percent of clay.

Saturation Percentage - The moisture percentage of a saturated soil paste, expressed on an oven dry weight basis.

Seepage -

1. The escape of water downward through the soil.
2. The emergence of water from the soil along an extensive line of surface in contrast to a spring where water emerges from a local spot.

Series, soil - A category in the Canadian System of Soil Classification. It consists of soils that have soil horizons similar in their differentiating characteristics and arrangement in the profile, except for surface texture and are formed from a particular type of parent material.

Shrinkage limit - This is the moisture content at which an equilibrium condition of volume change is reached and further reduction in moisture content will not cause a decrease in the volume of the soil mass.

Shrinkage ratio - This is the ratio between the volume change and a corresponding change in moisture content. It equals the apparent specific gravity of the dried soil.

Silt - (a) Individual mineral particles of soil that range in diameter between 0.05 to .002 mm. (b) Soil of the textural class silt contains greater than 80 percent silt and less than 12 percent clay.

Slickenside - Smoothed surfaces along planes of weakness resulting from the movement of one mass of soil against another in soils dominated by swelling clays.

Sodium-Adsorption Ratio (*S.A.R.*) - A ratio for soil extracts and irrigation waters used to express the relative activity of sodium ions in exchange reactions with other cations in the soil SAR = $Na/((Ca+Mg)/2)^{1/2}$ where the cation concentrations are expressed as milliequivalents per litre.

Soil - The unconsolidated mineral material on the immediate surface of the earth that serves as a natural medium for the growth of land plants. Soil has been subjected to and influenced by genetic and environmental factors of: parent material, climate (including moisture and temperature effects), macro- and micro-organisms, and topography, all acting over a period of time.

Solum - The upper horizons of a soil above the parent material and in which the processes of soil formation are active. It usually comprises the A and B horizons.

Stones - Rock fragments greater than 25 cm in diameter.

Stoniness - The percentage of land surface occupied by stones. The classes of stoniness are defined as follows:

Stones 0. *Nonstony* -- Land having less than 0.01% of surface occupied by stones.

Stones 1. *Slightly stony* -- Land having 0.01-0.1% of surface occupied by stones. Stones 15-30 cm in diameter, 10-30 m apart. The stones offer only slight to no hindrance to cultivation.

Stones 2. *Moderately stony* -- Land having 0.1-3% of surface occupied by stones. Stones 15-30 cm in diameter, 2-10 m apart. Stones cause some interference with cultivation.

Stones 3. *Very stony* -- Land having 3-15% of surface occupied by stones. Stones 15-30 cm in diameter, 1-2 m apart. There are sufficient stones to constitute a serious handicap to cultivation.

Stones 4. *Exceedingly stony* -- Land having 15-50% of surface occupied by stones. Stones 15-30 cm in diameter, 0.7-1.5 m apart. There are sufficient stones to prevent cultivation until considerable clearing has been done.

Stones 5. *Excessively stony* -- Land having more than 50% of surface occupied by stones. Stones 15-30 cm in diameter, less than 0.7 m apart. The land is too stony to permit cultivation.

Storage Capacity - Refers to the maximum amount of readily available water that can be stored within the rooting zone of a crop in a given soil. For practical irrigation purposes, 50 percent of the total soil water between field capacity and wilting point may be considered as readily available.

Stratified materials - Unconsolidated sand, silt and clay arranged in strata or layers. In stratified materials, a bed is a unit layer distinctly separable from other layers and is one or more cm thick but a lamina is a similar layer less than 1 cm thick.

Structure - The combination or arrangement of primary soil particles into aggregates of secondary soil particles, units or peds, which are separated from each other by surfaces of weakness. Structure is expressed in terms of grade, size class and shape type. Grade refers to the distinctness of aggregate development, and is described as structureless, weak, moderate or strong. Structureless refers to the absence of observable aggregation of definite orderly arrangement; the term amorphous is used if soil is massive or coherent, single-grained if noncoherent. The weak to strong aggregates vary in size and are described by class as fine, medium, coarse, and very coarse depending on the shape types. The shape types refers to the dominant configuration of the aggregates and the way they are accommodated. The general shape types are plate-like, block-like and prism-like. The terms are:

Platy - Having thin, plate-like aggregates with faces mostly horizontal

Prismatic - Having prism-like aggregates with tops and edges, appear plane, level and somewhat angular.

Columnar - Having prism-like aggregates with vertical edges near the top of columns, not sharp.

Granular - Having block-like aggregates that appear as spheroids or polyhedrons having plane or curved surfaces which have slight or no accommodation to the faces of the surrounding peds.

Blocky - Having block-like aggregates with sharp, angular corners

Subangular blocky - Having block-like aggregates with rounded and flattened faces and rounded corners.

By convention an aggregate is described in the order of grade, class and type, e.g. strong, medium, blocky. In the parent material of soils the material with structural shapes may be designated as pseudo-blocky, pseudo-platy, etc.

Soil Survey - The systematic examination, description, classification, and mapping of soil in an area.

Sulfate Hazard - Refers to the relative degree of attack on concrete by soil and water containing various amounts of sulfate ions. It is estimated from electrolyte measurements and salt analysis on selected profiles and soil samples, and by visual examination of free gypsum within the profile during the course of soil investigation.

Swamp - See Description of Landforms

Texture, soil - The relative proportions of the fine earth (less than 2 mm.) fraction of a soil. Textural classes are usually assigned to specific horizons whereas family particle size classes indicate a composite particle size of a portion of the control section that may include several horizons. See Texture Triangle at end of Glossary.

The size range of the constituent primary particles are as follows:

	Diameter (mm)
Very coarse sand	2.0-1.0
Coarse sand	1.0-0.5
Medium sand	0.5-0.25
Fine sand	0.25-0.10
Very fine sand	0.10-0.05
Silt	0.05-0.002
Clay	< 0.002
Fine clay	< 0.0002

Till, glacial - Unstratified glacial deposits consisting of clay, sand, gravel, and boulders intermingled in any proportion.

Tilth - The physical condition of soil as related to its ease of tillage, fitness as a seedbed, and its impedance to seedling emergency and root penetration.

Topography - Refers to the percent slope and the pattern or frequency of slopes in different directions. A set of 10 slope classes are used to denote the dominant but not necessarily most abundant slopes within a mapping unit.

Slope Class	Slope Name	Percent slope	Approx. degrees
1	level	0-0.5	0
2	nearly level	.5-2.5	.3-1.5
3	very gentle	2-5	1-3
4	gentle	6-9	3.5-5
5	moderate	10-15	6-8.5
6	strong	16-30	9-17
7	very strong	31-45	17-24
8	extreme	46-70	25-35
9	steep	71-100	35-45
10	very steep	>100	>45

Underground runoff - (or seepage)-Water flowing towards stream channels after infiltration into the ground.

Unified Soil Classification System (engineering) - A classification system based on the identification of soils according to their particle size, gradation, plasticity index and liquid limit.

Urban Land - Areas so altered or obstructed by urban works or structures that identification of soils is not feasible.

Variant, soil - A soil whose properties are believed to be sufficiently different from other known soils to justify a new series name, but comprising such a limited geographic area that creation of a new series is not justified.

Varve - A distinct band representing the annual deposit in sedimentary materials regardless of origin and usually consisting of two layers, one thick light colored layer of silt and fine sand laid down in the spring and summer, and the other a thin, dark colored layer of clay laid down in the fall and winter.

Water balance, soil - Is the daily amount of readily available water retained by the soil. The daily soil-water balance is decreased by the amount that the daily consumptive use exceeds the daily rainfall. When daily rainfall exceeds the consumptive use, the daily balance increases by the amount of the difference unless the soil-water balance is at storage capacity, in which case the excess is assumed to be lost by runoff or deep percolation.

Water table - (groundwater surface; free water surface; groundwater elevation) Elevation at which the pressure in the water is zero with respect to the atmospheric pressure.

Water-holding capacity - The ability of a soil to hold water against the force of gravity in a freely drained soil.

Weathering - The physical and chemical disintegration, alteration and decomposition of rocks and minerals at or near the earth's surface by atmospheric agents.

Xerophyte - Plants capable of surviving extended periods of soil drought.

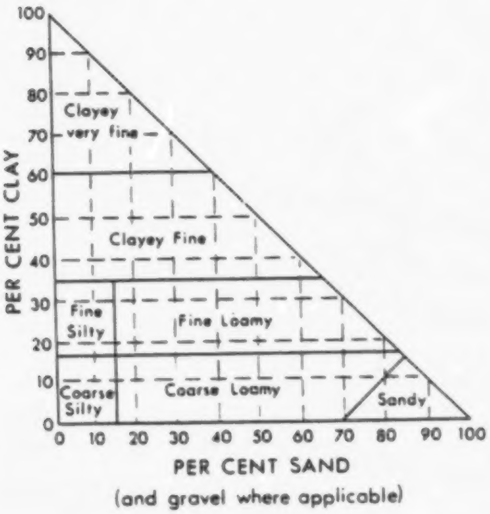
100
90
80
70
60
50
40
30
20
10
0
PER CENT CLAY
Clayey very fine
Clayey Fine
Fine Silty
Fine Loamy
Coarse Silty
Coarse Loamy
Sandy
0
10
20
30
40
50
60
70
80
90
100
PER CENT SAND
(and gravel where applicable)

Figure 9: Family particle-size classes.

Texture Group	Class Symbol	Class Name
Coarse	S LS	sand loamy sand
Moderately coarse	SL LVFS	sandy loam loamy very fine sand
Medium	Si SiL L VFSL	silt silt loam loam very fine sandy loam
Moderately fine	SCL CL SiCL	sandy clay loam clay loam silty clay loam
Fine	SC C SiC	sandy clay clay silty clay
Very fine	HC	heavy clay

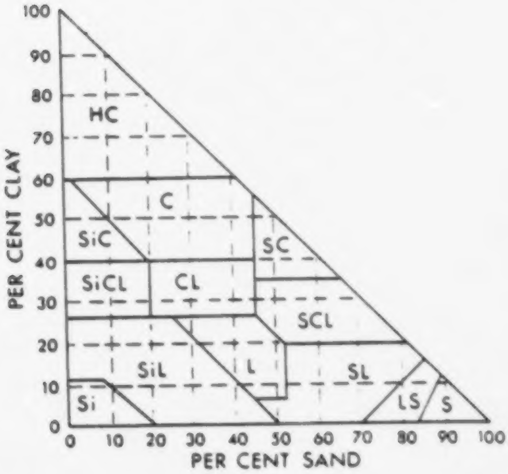
100
90
80
70
60
50
40
30
20
10
0
PER CENT CLAY
HC
C
SiC
SC
SiCL
CL
SCL
SiL
L
SL
Si
LS
S
0
10
20
30
40
50
60
70
80
90
100
PER CENT SAND

Figure 10: Soil Textural Classes.

Appendix B

SOIL HORIZON DESIGNATIONS

ORGANIC HORIZONS

Organic horizons are found in Organic soils, and commonly at the surface of mineral soils. They may occur at any depth beneath the surface in buried soils, or overlying geologic deposits. They contain more than 17% organic carbon (approximately 30% organic matter) by weight. Two groups of these horizons are recognized, O horizons and the L, F, and H horizons.

O This is an organic horizon developed mainly from mosses, rushes, and woody materials.

Of The fibric horizon is the least decomposed of all the organic soil materials. It has large amounts of well-preserved fiber that are readily identifiable as to botanical origin. A fibric horizon has 40% or more of rubbed fiber by volume and a pyrophosphate index of 5 or more. If the rubbed fiber volume is 75% or more, the pyrophosphate criterion does not apply.

Om The mesic horizon is the intermediate stage of decompostion with intermediate amounts of fiber, bulk density and water-holding capacity. The material is partly altered both physically and biochemically. A mesic horizon is one that fails to meet the requirements of fibric or humic.

Oh The humic horizon is the most highly decomposed of the organic soil materials. It has the least amount of fiber, the highest bulk density, and the lowest saturated water-holding capacity. It is very stable and changes very little physically or chemically with time unless it is drained. The humic horizon has less than 10% rubbed fiber by volume and a pyrophosphate index of 3 or less.

LFH These organic horizons developed primarily from leaves, twigs, woody materials and a minor component of mosses under imperfectly to well drained forest conditions.

L This is an organic horizon characterized by an accumulation of organic matter in which the original structures are easily discernible.

F This is an organic horizon characterized by an accumulation of partly decomposed organic matter. The original structures in part are difficult to recognize. The horizon may be partly comminuted by soil fauna as in moder, or it may be a partly decomposed mat permeated by fungal hyphae as in mor.

H This is an organic horizon characterized by an accumulation of decomposed organic matter in which the original structures are indiscernible. This material differs from the F horizon by its greater humification chiefly through the action of organisms. It is frequently intermixed with mineral grains, especially near the junction with the mineral horizon.

MASTER MINERAL HORIZONS

Mineral horizons are those that contain less than 30% organic matter by weight as specified for organic horizons.

A This is a mineral horizon or horizons formed at or near the surface in the zone of leaching or removal of materials in solution and suspension or of maximum in situ accumulation of organic matter, or both. Included are:

1. horizons in which organic matter has accumulated as a result of biological activity (Ah);
2. horizons that have been eluviated of clay, iron, aluminum, or organic matter, or all of them (Ae);
3. horizons having characteristics of 1) and 2) above but transitional to underlying B or C (AB or A and B);
4. horizons markedly disturbed by cultivation or pasture (Ap).

B This is a mineral horizon or horizons characterized by one or more of the following:

1. an enrichment in silicate clay, iron, aluminum, or humus, alone or in combination (Bt,Bf,Bfh,Bhf, and Bh);
2. a prismatic or columnar structure that exhibits pronounced coatings or stainings and significant amount of exchangeable Na (Bn);
3. an alteration by hydrolysis, reduction, or oxidation to give a change in color or structure from horizons above or below, or both, and does not meet the requirements of 1) and 2) above (Bm,Bg).

C This is a mineral horizon or horizons comparatively unaffected by the pedogenic processes operative in A and B, excepting (i) the process of gleying, and (ii) the accumulation of calcium and magnesium carbonates and more soluble salts (Cca,Csa,Cg, and C). Marl and diatomaceous earth are considered to be C horizons.

R This is consolidated bedrock that is too hard to break with the hands or to dig with a spade when moist and that does not meet the requirement of a C horizon. The boundary between the R layer and overlying unconsolidated material is called a lithic contact.

W This is a layer of water in Gleysolic, Organic, or Cryosolic soils. It is called a hydric layer in Organic soils.

LOWER-CASE SUFFIXES

b Buried soil horizon.

c A cemented (irreversible) pedogenic horizon. The ortstein of a Podzol, and a layer cemented by calcium carbonate and a duripan are examples.

ca	A horizon with secondary carbonate enrichment where the concentration of lime exceeds that present in the unenriched parent material. It is more than 10 cm thick, and if it has a $CaCO3$ equivalent of less than 15 percent it should have at least 5 percent more $CaCO3$ equivalent than the parent material (IC). If it has more than 15 percent $CaCO3$ equivalent it should have 1/3 more $CaCO3$ equivalent than the IC. If no IC is present, this horizon is more than 10 cm thick and contains more than 5 percent by volume of secondary carbonates in concretions or soft, powdery forms.
cc	Cemented (irreversible) pedogenic concretions.
e	A horizon characterized by the eluviation of clay, iron, aluminum, or organic matter alone or in combination. When dry, it is usually higher in color value by 1 or more units than an underlying B horizon. It is used with A (Ae).
f	A horizon enriched with amorphous material, principally Al and Fe combined with organic matter. It usually has a hue of 7.5YR or redder or its hue is 10YR near the upper boundary and becomes yellower with depth. When moist, the chroma is higher than 3 or the value is 3 or less. It contains 0.6% or more pyrophosphate-extractable Al+Fe in textures finer than sand and 0.4% or more in sands (coarse sand, sand, fine sand, and very fine sand). The ratio of pyrophosphate-extractable Al+Fe to clay (less than 0.002mm) is more than 0.05 and organic C exceeds 0.5%. Pyrophosphate-extractable Fe is at least 0.3%, or the ratio of organic C to pyrophosphate-extractable Fe is less than 20, or both are true. It is used with B alone (Bf), with B and h (Bhf), with B and g (Bfg), and with other suffixes. The criteria for "f" do not apply to Bgf horizons. The following horizons are differentiated on the basis of organic carbon content: Bf - 0.5% to 5% organic carbon. Bhf-more than 5% organic carbon.
g	A horizon characterized by gray colors, or prominent mottling, or both, indicative of permanent or periodic intense reduction. Chromas of the matrix are generally 1 or less. It is used with A and e (Aeg); with B alone (Bg); with B and f (Bfg); with B, h, and f (Bhfg); with B and t (Btg); with C alone (Cg); with C and k (Ckg); and several others. In some reddish parent materials, matrix colors of reddish hues and high chromas may persist despite long periods of reduction. In these soils, horizons are designated as g if there is gray mottling or if there is marked bleaching on ped faces or along cracks.

Aeg	This horizon must meet the definitions of A,e, and g.
Bg	These horizons are analogous to Bm horizons but they have colors indicative of poor drainage and periodic reduction. They include horizons occurring between A and C horizons in which the main features are (i) colors of low chroma, that is: chromas of 1 or less, without mottles on ped surfaces or in the matrix if peds are lacking; or chromas of 2 or less in hues of 10YR or redder, on ped surfaces or in the matrix if peds are lacking, accompanied by more promi-

nent mottles than those in the C horizon; or hues bluer than 10Y, with or without mottles on ped surfaces or in the matrix if peds are lacking. (ii) colors indicated in (i) and a change in structure from that of the C horizons. (iii) color indicated in (i) and illuviation of clay too slight to meet the requirements of Bt; or accumulation or iron oxide too slight to meet the limits of Bgf. (iv) colors indicated in (i) and removal of carbonates. Bg horizons occur in some Orthic Humic Gleysols and some Orthic Gleysols.

Bfg, Bhfg, Btg, and others. When used in any of these combinations the limits set for f, hf, t, and others must be met.

Bgf The dithionite-extractable Fe of this horizon exceeds that of the IC by 1% or more. Pyrophosphate-extractable Al + Fe is less than the minimum limit specified for 'f' horizons. This horizon occurs in Fera Gleysols and Fera Humic Gleysols, and possibly below the Bfg of gleyed Podzols. It is distinguished from the Bfg of gleyed Podzols on the basis of the extractability of the Fe and Al. The Fe in the Bgf horizon is thought to have accumulated as a result of the oxidation of ferrous iron. The iron oxide formed is not associated intimately with organic matter or with Al, and it is sometimes crystalline. The Bgf horizons are usually prominently mottled, with more than half of the soil material occurring as mottles of high chroma.

Cg, Ckg, Ccag, Csg, Csag. When g is used with C alone, or with C and one of the lower-case suffixes k, ca, s, or sa, it must meet the difinition for C and for the particular suffix.

h A horizon enriched with organic matter. It is used with A alone (Ah); or with A and e (Ahe); or with B alone (Bh); or with B and f (Bhf).

Ah A horizon enriched with organic matter that either has a color value at least one unit lower than the underlying horizon or contains 0.5% more organic carbon than the IC, or both. It contains less than 17% organic carbon by weight.

Ahe An Ah horizon that has undergone eluviation as evidenced, under natural conditions, by streaks and splotches of differing shades of gray and often by platy structure. It may be overlain by a darker-colored Ah and underlain by a lighter-colored Ae.

Bh This horizon contains more than 1% organic carbon, less than 0.3% pyrophosphate-extractable Fe, and has a ratio of organic carbon to pyrophosphate-extractable Fe of 20 or more. Generally the color value and chroma are less than 3 when moist.

Bhf Defined under 'f'.

j Used as a modifier of the suffixes e, f, g, n, and t to denote an expression of, but failure to meet, the specified limits of the suffix it modifies. It must be placed to the right and adjacent to the suffix it modifies. For example Bfgj means a Bf horizon with weak expression of gleying; Bfjgj means a B horizon with weak expression of both 'f' and 'g' features.

Aej It denotes an eluvial horizon that is thin, discontinuous or slightly discernible.

Btj It is a horizon with some illuviation of clay, but not enough to meet the limits of Bt.

Btgj, Bmgj. Horizons that are mottled but do not meet the criteria of Bg.

Bfj It is a horizon with some accumulation of pyrophosphate-extractable Al and Fe but not enough to meet the limits of Bf.

Bntj or Bnj. Horizons in which development of solonetzic B properties is evident but insufficient to meet the limits for Bn or Bnt.

k Denotes the presence of carbonate, as indicated by visible effervescence when dilute HCl is added. Most often it is used with B and m (Bmk) or C (Ck), and occasionally with Ah or Ap (Ahk, Apk), or organic horizons (Ofk, Omk).

m A horizon slightly altered by hydrolysis, oxidation, or solution, or all three, to give a change in color or structure, or both. It has:

1. Evidence of alteration in one of the following forms:
   a) Higher chromas and redder hues than the underlying horizons.
   b) Removal of carbonates, either partially (Bmk) or completely (Bm).
2. Illuviation, if evident, too slight to meet the requirements of a Bt or a podzolic B.
3. Some weatherable minerals.
4. No cementation or induration and lacks a brittle consistence when moist. This suffix can be used as Bm, Bmgj, Bmk, and Bms.

n A horizon in which the ratio of exchangeable Ca to exchangeable Na is 10 or less. It must also have the following distinctive morphological characteristics: prismatic or columnar structure, dark coatings on ped surfaces, and hard to very hard consistence when dry. It is used with B, as Bn or Bnt.

p A horizon disturbed by man's activities, such as cultivation, logging, habitation, etc. It is used with A and O.

s A horizon with salts, including gypsum, which may be detected as crystals or veins, as surface crusts of salt crystals, by depressed crop growth, or by the presence of salt-tolerant plants. It is commonly used with C and k (Csk), but can be used with any horizon or combination of horizon and lowercase suffix.

sa A horizon with secondary enrichment of salts more soluble than calcium and magnesium carbonates, in which the concentration of salts exceeds that present in the unenriched parent material. The horizon is 10 cm or more thick. The conductivity of the saturation extract must be at least 4 ms/cm and must exceed that of the C horizon by at least one-third.

t An illuvial horizon enriched with silicate clay. It is used with B alone (Bt), with B and g (Btg), with B and n (Bnt), etc.

Bt A Bt horizon is one that contains illuvial layer-lattice clays. It forms below an eluvial horizon, but may occur at the surface of a soil that has been partially truncated. It usually has a higher ratio of fine clay to total clay than IC. It has the following properties:

1. If any part of an eluvial horizon remains and there is no lithologic discontinuity between it and the Bt horizon, the Bt horizon contains more total and fine clay than the eluvial horizons, as follows:
    a) If any part of the eluvial horizon has less than 15% total clay in the fine earth fraction (2mm) the Bt horizon must contain at least 3% more clay, e.g.,Ae 10% clay-Bt minimum 13% clay.
    b) If the eluvial horizon has more than 15% and less than 40% total clay in the fine earth fraction, the ratio of the clay in the Bt horizon to that in the eluvial horizon must be 1.2 or more, e.g., 20% clay increase in the Bt over Ae.
    c) If the eluvial horizon has more than 40% total clay in the fine earth fraction, the Bt horizon must contain at least 8% more clay than the eluvial horizon, e.g. Ae 50% clay; Bt at least 58% clay.
2. A Bt horizon must be at least 5 cm thick. In some sandy soils where clay accumulation occurs in the lamellae, the total thickness of the lamellae should be more than 10 cm in the upper 150 cm of the profile.
3. In massive soils the Bt horizon should have oriented clays in some pores and also as bridges between the sand grains.
4. If peds are present, a Bt horizon shows clay skins on some of the vertical and horizontal ped surfaces and in the fine pores, or shows oriented clays in 1% or more of the cross section, as viewed in thin section.
5. If a soil shows a lithologic discontinuity between the eluvial

horizon and the Bt horizon, or if only a plow layer overlies the Bt horizon, the Bt horizon need show only clay skins in some part, either in some fine pores or on some vertical and horizontal ped surfaces. Thin sections should show that some part of the horizon has about 1% or more of oriented clay bodies.

Btj, Btj, and Btg are defined under j and g.

u A horizon that is markedly disrupted by physical or faunal processes other than cryoturbation. Evidence of marked disruption such as the inclusion of material from other horizons, absence of the horizon, etc. must be evident in at least half of the cross section of the pedon. Such turbation can result from blowdown of trees, mass movement of soil on slopes, and burrowing animals. It can be used with any horizon or subhorizon with the exception of A or B alone; e.g. Aeu, Bfu, BCu.

x A horizon of fragipan character. A fragipan is a loamy subsurface horizon of high bulk density and very low organic matter content. When dry, it has a hard consistence and seems to be cemented. When moist, it has moderate to weak brittleness. It frequently has bleached fracture planes and is overlain by a friable B horizon. Air dry clods of fragic horizons slake in water.

y A horizon affected by cryoturbation as manifested by disrupted and broken horizons,, incorporation of materials from other horizons and mechanical sorting in at least half of the cross section of the pedon. It is used with A, B, and C alone or in combination with other subscripts, e.g. Ahy, Ahgy, Bmy, Cy, Cgy, Cygj, etc.

z A frozen layer. It may be used with any horizon or layer, e.g. Ohz, Bmz, Cz, Wz.

Appendix C

DESCRIPTION OF LANDFORMS

C.1. GENETIC MATERIALS

Unconsolidated mineral component

The unconsolidated mineral component consists of clastic sediments that may or may not be stratified, but whose particles are not cemented together. They are essentially of glacial or post-glacial origin but include poorly consolidated and weathered bedrock.

Anthropogenic - Man-made or man-modified materials, including those associated with mineral exploitation and waste disposal.

Colluvial - Massive to moderately well stratified, nonsorted to poorly sorted sediments with any range of particle sizes from clay to boulders and blocks that have reached their present position by direct, gravity-induced movement.

They are restricted to products of mass-wasting whereby the debris is not carried by wind, water, or ice (excepting snow avalanches).

Eolian - Sediment, generally consisting of medium to fine sand and coarse silt particle sizes, that is well sorted, poorly compacted, and may show internal structures such as cross bedding or ripple laminae, or may be massive. Individual grains may be rounded and show signs of frosting.

These materials have been transported and deposited by wind action.

Fluvial - Sediment generally consisting of gravel and sand with a minor fraction of silt and clay. The gravels are typically rounded and contain interstitial sand. Fluvial sediments are commonly moderately to well sorted and display stratification, but massive, nonsorted fluvial gravels do occur. These materials have been transported and deposited by streams and rivers. Finer textured Fluvial deposits of modern rivers are termed Alluvium.

Lacustrine - Sediment generally consisting of either stratified fine sand, silt, and clay deposited on the lake bed; or moderately well sorted and stratified sand and coarser materials that are beach and other nearshore sediments transported and deposited by wave action.

These are materials that either have settled from suspension in bodies of standing fresh water or have accumulated at their margins through wave action.

Marine - Unconsolidated deposits of clay, silt, sand, or gravel that are well to moderately well sorted and well stratified to moderately stratified (in some places containing shells). They have settled from suspension in salt or brackish water bodies or have accumulated at their margins through shoreline processes such as wave action and longshore drift.

Morainal - Sediment generally consisting of well compacted material that is nonstratified and contains a heterogeneous mixture of particle sizes, often in a mixture of sand, silt, and clay that has been transported beneath, beside, on, within and in front of a glacier and not modified by any intermediate agent.

Saprolite - Rock containing a high proportion of residual silts and clays formed by alteration, chiefly by chemical weathering.

The rock remains in a coherent state, interstitial grain relationships are undisturbed and no downhill movement due to gravity has occurred.

Undifferentiated - A layered sequence of more than three types of genetic material outcropping on a steep erosional escarpment.

Volcanic - Unconsolidated pyroclastic sediments. These include volcanic dust, ash, cinders, and pumice.

Qualifying Descriptors

These have been introduced to qualify the genetic materials and to supply additional information about the mode of formation or depositional environment.

Glacial - Used to qualify nonglacial genetic materials or process modifiers where there is direct evidence that glacier ice exerted a strong but secondary or indirect control upon the mode of origin of the materials or mode of operation of the process. The use of this qualifying descriptor implies that glacier ice was close to the site of the deposition of a material or the site of operation of a process.

Glaciofluvial - Fluvial materials showing clear evidence of having been deposited either directly in front of or in contact with glacier ice.

Glaciolacustrine - Lacustrine materials deposited in contact with glacial ice.

Glaciomarine - Materials of glacial origin laid down in a marine environment, as a result of settling from melting, floating ice and ice shelves.

Organic component

The organic component consists of peat deposits containing >30% organic matter by weight that may be as thin as 10 cm if they overlie bedrock but are otherwise greater than 40 cm and generally greater than 60 cm thick. The classes and their definitions follow.

B	Bog
N	Fen
S	Swamp

Bog - A bog is a peat-covered or peat-filled area, generally with a high water table. Since the surface of the peatland is slightly elevated, bogs are either unaffected or partly affected by nutrient-rich groundwaters from the surrounding mineral soils. The groundwater is generally acidic and low in nutrients (ombrotrophic). The dominant peat materials are sphagnum and forest peat, underlain, at times, by fen peat.

Fen - A fen is a peat-covered or peat-filled area with a high water table, which is usually at the surface. The dominant materials are shallow to deep, well to moderately decomposed fen peat. The waters are mainly rich in nutrients (minerotrophic) and are derived from mineral soils. The peat materials are therefore higher in both nutrients and pH than the peats associated with bogs.

Swamp - A swamp is a peat-covered or peat-filled area. The peat surface is level or slightly concave in cross section. The water table is frequently at or above the peat surface. There is strong water movement from margins or other mineral sources. The microrelief is hummocky, with many pools present. The waters are neutral or slightly acid. The dominant peat materials are shallow to deep mesic to humic forest and fen peat.

C.2 GENETIC MATERIAL MODIFIERS

Material modifiers are used to qualify unconsolidated mineral and organic deposits. Particle-size classes serve to indicate the size, roundness, and sorting of unconsolidated mineral deposits. Fiber classes indicate the degree of decomposition and fiber size of organic materials.

Particle size classes for unconsolidated mineral materials

Blocky: An accumulation of angular particles greater than 256 mm in size.

Bouldery: An accumulation of rounded particles greater than 256 mm in size.

Clayey: An accumulation of particles where the fine earth fraction contains 35% or more clay (<0.002 mm) by weight and particles greater than 2 mm are less than 35% by volume.

Cobbly: An accumulation of rounded particles having a diameter of 64-256 mm.

Gravelly: An accumulation of rounded particles ranging in size from pebbles to boulders.

Loamy: An accumulation of particles of which fine earth fraction contains 35% or less clay (<0.002 mm) by weight and particles greater than 2 mm are less than 35% by volume.

Pebbly: An accumulation of rounded particles having a diameter of 2-64 mm.

Rubbly: An accumulation of angular fragments having a diameter of 2-256 mm.

Sandy: An accumulation of particles of which the fine earth fraction contains more than 70% by weight of fine sand or coarser particles. Particles greater than 2 mm occupy less than 35% by volume.

Silty: An accumulation of particles of which the fine earth fraction contains less than 15% of fine sand or coarser particles and has less than 35% clay. Particles greater than 2 mm occupy less than 35% by volume.

Fiber classes for organic materials

The amount of fiber and its durability are important characterizing features of organic deposits in that they reflect on the degree of decomposition of the material. The prevalence of woody materials in peats is also of prime importance.

Fibric: The least decomposed of all organic materials; there is a large amount of well-preserved fiber that is readily identifiable as to botanical origin. Fibers retain their character upon rubbing.

Mesic: Organic material in an intermediate stage of decompostion; intermediate amounts of fiber are present that can be identified as to their botanical origin.

Humic: Highly decomposed organic material; small amounts of fiber are present that can be identified as to their botanical origin. Fibers can be easily destroyed by rubbing.

Woody: Organic material containing more than 50% of woody fibers.

C.3 SURFACE EXPRESSION

The surface expression of genetic materials is their form (assemblage of slopes) and pattern of forms. Form as applied to unconsolidated deposits refers specifically to the product of the initial mode of origin of the materials. When applied to consolidated materials, form refers to the product of their modification by geological processes. Surface expression also indicates the manner in which unconsolidated genetic materials relate to the underlying unit.

Consolidated and Unconsolidated mineral surface classes

Apron - A relatively gentle slope at the foot of a steeper slope and formed by materials from the steeper, upper slope.

Blanket - A mantle of unconsolidated materials thick enough to mask minor irregularities in the underlying unit but still conforming to the general underlying topography.

Fan - A fan-shaped form similar to the segment of a cone and having a perceptible gradient from the apex to the toe.

Hummocky - A very complex sequence of slopes extending from somewhat rounded depressions or kettles of various sizes to irregular to conical knolls or knobs. There is a general lack of concordance between knolls or depressions. Slopes are generally 9-70% (5-35 degrees).

Inclined - A sloping, unidirectional surface with a generally constant slope not broken by marked irregularities. Slopes are 2-70% (1-35 degrees). The form of inclined slopes is not related to the initial mode of origin of the underlying material.

Level - A flat or very gently sloping, unidirectional surface with a generally constant slope not broken by marked elevations and depressions. Slopes are generally less than 2% (1 degree).

Rolling - A very regular sequence of moderate slopes extending from rounded, sometimes confined concave depressions to broad, rounded convexities producing a wavelake pattern of moderate relief. Slope length is often 1.6 km or greater and gradients are greater than 5% (3 degrees).

Ridged - A long, narrow elevation of the surface, usually sharp crested with steep sides. The ridges may be parallel, subparallel, or intersecting.

Steep - Erosional slopes, greater than 70% (35 degrees), on both consolidated and unconsolidated materials. The form of a steep erosional slope on unconsolidated materials is not related to the initial mode of origin of the underlying material.

Terraced - Scarp face and the horizontal or gently inclined surface (tread) above it.

Undulating - A very regular sequence of gentle slopes that extends from rounded, sometimes confined concavities to broad rounded convexities producing a wavelike pattern of low local relief. Slope length is generally less than 0.8 km and the dominant gradient of slopes is 2-5% (1-3 degrees).

Veneer - Unconsolidated materials too thin to mask the minor irregularities of the underlying unit surface. A veneer will range from 10 cm to 1 m in thickness and will possess no form typical of the material's genesis.

Organic surface classes

Blanket - A mantle of organic materials that is thick enough to mask minor irregularities in the underlying unit but still conforms to the general underlying topography.

Bowl - A bog or fen occupying concave-shaped depressions.

Domed - A bog with an elevated, convex, central area much higher than the margin. Domes may be abrupt (with or without a frozen core) or gently sloping or have a stepped surface.

Floating - A level organic surface associated with a pond or lake and not anchored to the lake bottom.

Horizontal - A flat peat surface not broken by marked elevations and depressions.

Plateau - A bog with an elevated, flat, central area only slightly higher than the margin.

Ribbed - A pattern of parallel or reticulate low ridges associated with fens.

Sloping - A peat surface with a generally constant slope not broken by marked irregularities.

Veneer - A thin (40 cm-1m) mantle of organic materials which generally conforms to the underlying topography. They may or may not be associated with discontinuous permafrost.

Appendix D

GUIDES FOR EVALUATING SOIL SUITABILITY FOR SELECTED USES

TABLE 10

Land Classification Standards for Irrigation Suitability

Land Characteristics	Subclass	Class 1 - Very Good	Class 2 - Good	Class 3 - Fair	Class 4 - Poor
SOILS	S				
Texture very coarse textured very fine textured	v h	Fine sandy loams to clay loams	Loamy fine sand to light clay	Sand to permeable clay	Gravel to clay
Water holding capacity low available moisture capacity	q	40 to 60 sat. % >15cm storage in 1.2m <10cm/hr. hydraulic cond.	35 to 65 sat. % >12.5cm storage in 1.2m <12.5cm/hr. hydraulic cond.	25 to 75 sat. % >7.5cm storage in 1.2m <17.5cm/hr. hydraulic cond.	<25 or >75 sat. % <7.5cm storage in 1.2m >17.5cm/hr. hydraulic cond.
Geological Deposit shallow deposit over sand or gravel	k	.9m or more of fine sandy loam or heavier	.6m or more of fine sandy loam or heavier, or .75m plus of loamy fine sand or sandy loam	.5m or more of sandy loam or heavier, or .6m plus of loamy sand	<.5m of sandy loam or heavier, or .6m of loamy sand or sand
shallow deposit over impervious substrata	b	>3m of permeable material	>2m of permeable material	>1m of permeable material	<1m of permeable material
Salinity and Alkalinity^{1,2}	a	<4 ms/cm in 0-.6m <8 ms/cm below .6m <6 S.A.R.	<4 ms/cm in 0-.6m <12 ms/cm below .6m <8 S.A.R.	<8 ms/cm in 0-.6m <15 ms/cm below .6m <12 S.A.R.	>8 ms/cm in 0-.6m >15 ms/cm below .6m >12 S.A.R.
EXTERNAL FEATURES Stones - rock clearing	r	None to light clearing	Light to medium clearing	Light to heavy clearing	Excessively stony
Topography Slope excess gradient	T g	<1% and 0.1% in general gradient (0-3% slope)	<3% in general gradient (3-5% slope)	<5% in general gradient (5-10% slope)	>5% in general* gradient (>10% slope)**
DRAINAGE restricted outlet	D	No problem anticipated	Moderate drainage problem anticipated but may be improved at relatively low cost	Moderate to severe drainage problem anticipated but may be improved by expensive but feasible measures	Drainage improvement not considered feasible
water table		below 2.4m most of year	could be above 1.5m for a short period, then recedes to 2.4m or lower	within 1.5m most of year	within 1m most of year

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* Criteria for gravity (flood) irrigation requirements.

** Estimated adjustments to slope criteria for overhead or sprinkler type irrigation methods.

[1] If sufficient gypsum is present in the soil, the S.A.R. may be lowered by leaching the soil (a very slow process), and the hydraulic conductivity may then improve.

[2] The degree of salinity may vary widely within short distances, and there may be no clear indication of the area occupied by each salinity class. Unless a very detailed mapping and sampling program is carried out, it is impossible to estimate the acreage occupied by each salinity class.

TABLE 11

Guide for assessing soil suitability as source of topsoil

The term "topsoil" includes soil materials used to cover barren surfaces exposed during construction, and materials used to improve soil conditions on lawns, gardens, flower beds, etc. The factors to be considered include not only the characteristics of the soil itself, but also the ease or difficulty of excavation, and where removal of topsoil is involved, accessibility to the site.

Symbol1/	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence2/	Very friable, friable	Loose, firm	Very firm	Cemented
i	Flooding	None	May flood occasionally for short periods	Frequent flooding	Constantly flooded
w	Wetness2/	Wetness is not determining if better than very poorly drained.			Very poorly drained and permanently wet soils
t	Slope	0-5%	5-9%	9-15%	>15%
p	Stoniness2/	Stones 10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones 0.1 m apart (Class 5)
c	Coarse fragments2/: percent, by volume	<3%	3-15%	15-35%	>35%
s	Texture2/	FSL, VFSL, L, SiL, SL, SC if 1:1 clay is dominant	CL, SCL, SiCL, SC if 2:1 clay is dominant; c and sic if 1:1 clay is dominant	S, LS, C and SiC if 2:1 clay is dominant. organic soils3/	Marl, diatomaceous earth
b	Depth of Topsoil4/	>40 cm	15-40 cm	8-15 cm	<8 cm
n	Salinity of Topsoil5/	E.C. 0-1	E.C. 1-4	E.C. 4-8	E.C. >8

1/ The symbols are used to indicate the nature of the limitation.

2/ For an explanation of texture, consistence, stoniness, coarse fragments and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

3/ Non-woody organic materials are assessed as good sources for topsoil if mixed with or incorporated into mineral soil.

4/ The remaining soil material (at least 8 cm) must be reclaimable after the uppermost soil is removed.

5/ E.C. = Electrical Conductivity (millisiemens/cm).

TABLE 12

Guide for assessing soil suitability as source of sand and gravel

The purpose of this table is to provide guidance for assessing the probable supply as well as quality of the sand or gravel for use as road base material and in concrete. The interpretation pertains mainly to the characteristics of the soil substratum to a depth of 150 cm, augmented by observations made in deep cuts as well as geological knowledge where available.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Unified Soil Group	SW SP GW GP	SW-SM SP-SM GP-GM GW-GM	SM SW-SC SP-SC GM GP-GC GW-GC	All other groups and bedrock
h	Depth to Seasonal Water Table	Not class determining if deeper than 50 cm		50 cm	
q	Depth to Sand and Gravel	<25 cm	25-75 cm[2]	>75 cm[2]	
p	Stoniness[3]	Not class determining if stones >.5 m apart (Class 0, 1, 2 and 3)		Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
d	Depth to Bedrock	>100 cm	50-100 cm	<50 cm	

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[1] The symbols are used to indicate the nature of the limitation.

[2] Rated good if it is known that the underlying gravel or sand deposit is thick (>100 cm).

[3] For an explanation of stoniness and rockiness, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

TABLE 13

Guide for assessing soil suitability as source of roadfill

Fill material for buildings or roads are included in this use. The performance of the material when removed from its original location and placed under load at the building site or road bed are to be considered. Since surface materials are generally removed during road or building construction their properties are disregarded. Aside from this layer, the whole soil to a depth of 150-200 cm should be evaluated. Soil materials which are suitable for fill can be considered equally suited for road subgrade construction.

Symbol1/	Items Affecting Use2/	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
a	Subgrade3/				
	a. AASHO group index4/	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC5/ and SC5/	CL (with P.I.6/ <15) and ML	CL (with P.I.6/ of 15 or more), CH and MH7/	OL, OH and Pt
1	Shrink-swell potential	Low	Moderate	High	
f	Susceptibility to frost action8/	Low	Moderate	High	
t	Slope	0-15%	15-30%	30-45%	>45%
p	Stoniness9/	Stones >2 m apart (Class 0, 1 and 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness9/	Rock exposures >35 m apart and cover <10% of the surface	Rock exposure 10-35 m apart and cover 10-25% of the surface	Rock exposure 3.5-10 m apart and cover 25-50% of the surface	Rock exposures <3.5 m apart and cover 50-90% of the surface
w	Wetness9/	Excessively drained to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
d	Depth to Bedrock	>100 cm	50-100 cm	20-50 cm	<20 cm
h	Depth to Seasonal Water Table	>150 cm	75-150 cm	50-75 cm	<50 cm

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1/ The symbols are used to indicate the nature of the limitation.

2/ The first three items pertain to soil after it is placed in a fill; the last six items pertain to soil in its natural condition before excavation for road fill.

3/ This item estimates the strength of the soil material, that is, its ability to withstand applied loads.

4/ Use AASHO group index only where laboratory data are available for the kind of soil being rated; otherwise, use Unified soil groups.

5/ Downgrade suitability rating to fair if content of fines is more than about 30 percent.

6/ P.I. means plasticity index.

7/ Upgrade suitability rating to fair if MH is largely kaolinitic, friable, and free of mica.

8/ Use this item only where frost penetrates below the paved or hardened surface layer and where moisture transportable by capillary movement is sufficient to form ice lenses at the freezing front.

9/ For an explanation of stoniness, rockiness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

TABLE 14

Guide for assessing soil suitability for permanent buildings

This guide applies to undisturbed soils to be evaluated for single-family dwellings and other structures with similar foundation requirements. The emphasis for rating soils for buildings is on foundation requirements; but soil slope, susceptibility to flooding and other hydrologic conditions, such as wetness, that have effects beyond those related exclusively to foundations are considered too. Also considered are soil properties, particularly depth to bedrock, which influence excavation and construction costs for the building itself and for the installation of utility lines. Excluded are limitations for soil corosivity, landscaping and septic tank absorption fields.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability[3]			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[4]	With Basements: Very rapidly, rapidly and well drained. Without Basements: Very rapidly, rapidly, well and moderately well drained.	With Basements: Moderately well drained. Without Basements: Imperfectly drained.	With Basements: Imperfectly, poorly, and very poorly drained. Without Basements: Poorly and very poorly drained.	With Basements: Permanently wet soils. Without Basements: Permanently wet soils.
h	Depth to Seasonal Water Table	With Basements: >150 cm Without Basements: >75 cm	With Basements: 75–150 cm Without Basements: 50–75 cm	With Basements: 25–75 cm Without Basements: 25–50 cm	With Basements: <25 cm Without Basements: <25 cm
i	Flooding	None	None	Occasional flooding (once in 5 years)	Frequent flooding (every year)
t	Slope[5]	0-9%	9-15%	15-30%	>30%
a	Subgrade[6]				
	a. AASHO group index[7]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM and GC and SC	CL (with P.I.[8] <15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and Pt
f	Potential Frost Action[9]	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness[4]	Stones >10 m apart (Class 0 to 1)	Stones 2-10 m apart (Class 2[10])	Stones 0.1-2 m apart (Class 3[10] to 4)	Stones <0.1 m apart (Class 5[10])
r	Rockiness[4],[11]	Rock exposures >100 m apart and cover < 2% of the surface	Rock exposures 30-100 m apart and cover 2-10% of the surface	Rock exposures <30 m apart and cover >10% of the surface	Rock exposures too frequent to allow location of permanent buildings
d	Depth to Bedrock[11]	With Basements: >150 cm Without Basements: >100 cm	With Basements: 100–150 cm Without Basements: 50–100 cm	With Basements: 50–100 cm Without Basements: <50 cm	With Basements: <50 cm

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[1] By halving the slope limits, this table can be used for evaluating soil suitability for buildings with large floor areas, but with foundation requirements not exceeding those of ordinary three-storey dwellings.

[2] The symbols are used to indicate the nature of the limitation.

[3] Some soils assessed as fair or poor may be good sites from an aesthetic or use standpoint, but they will require more site preparation and/or maintenance.

[4] For an explanation of rockiness, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Reduce the slope limits by one half for those soils subject to hillside slippage.

[6] This item estimates the strength of the soil, that is, its ability to withstand applied loads. When available, AASHO Group Index values from laboratory tests were used; otherwise the estimated Unified classes were used.

[7] Group index values were estimated from information published by the Portland Cement Association (PCA, 1962), pp. 23-25.

[8] P.I. means plasticity index.

[9] Frost heave only applies where frost penetrates to the assumed depth of the footings and the soil is moist. The potential frost action classes are taken from the United States Army Corps of Engineers (1962), pp. 5-8.

[10] Rate one class better for buildings without basements.

[11] Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment such as backhoes.

TABLE 15

Guide for assessing soil suitability for local roads and streets

This guide applies to soils to be evaluated for construction and maintenance of local roads and streets. These are improved roads and streets having some kind of all-weather surfacing, commonly asphalt or concrete, and are expected to carry automobile traffic all year. They consist of: (1) the underlying local soil material (either cut or fill) called the subgrade; (2) the base material of gravel, crushed rock, or lime or soil cement stabilized soil called the subbase; and (3) the actual road surface or pavement, either flexible or rigid. They also are graded to shed water and have ordinary provisions for drainage. With the probable exception of the hardened surface layer, the roads and streets are built mainly from the soil at hand, and cuts and fills are limited, usually less than 2 meters. Excluded from consideration in this guide are highways designed for fast-moving, heavy trucks.

Properties that affect design and construction of roads and streets are: (1) those that affect the load supporting capacity and stability of the subgrade, and (2) those that affect the workability and amount of cut and fill. The AASHO and Unified Classification give an indication of the traffic supporting capacity. Wetness and flooding affect stability. Slope, depth of hardrock, stoniness, rockiness, and wetness affect the ease of excavation and the amount of cut and fill to reach an even grade.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[3]	Very rapidly, rapidly, well and moderately well drained	Imperfectly drained	Poorly and very poorly drained	Permanently wet soils
i	Flooding	None	Infrequent (once in 5 years)	Occasional (once in 2-4 years)	Frequent (every year)
t	Slope	0-9%	9-15%	15-30%	>30%
d	Depth to Bedrock[4]	>100 cm	50-100 cm	<50 cm	
a	Subgrade[5]				
	a. AASHO group index[6]	0-4	5-8	>8	
	b. Unified soil classes	GW, GP, SW, SP, SM, GC[7] and SC[7]	CL (with P.I.[8] <15) and ML	CL (with P.I.[8] of 15 or more), CH and MH	OH, OL and Pt
f	Susceptibility to Frost Heave[9]	Low (F1, F2)	Moderate (F3)	High (F4)	
p	Stoniness[3]	Stones >2 m apart (Class 0 to 2)	Stones 0.5-2 m apart (Class 3)	Stones 0.1-0.5 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[3]	Rock exposures >100 m apart and cover <2% of the surface	Rock exposures 30-100 m apart and cover 2-10% of the surface	Rock exposures <30 m apart and cover >10% of the surface	Rock exposures too frequent to permit location of roads and streets

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[1] These guidelines, with some adjustment of slope and rockiness limits, will also be useful for assessing soils for use as parking lots.

[2] Symbols are used to indicate the nature of the limitation.

[3] For an explanation of stoniness, rockiness and soil drainage classes, see the Canada Soil Information System (Canada Soil Survey Committee, 1978).

[4] Rate one class better if the bedrock is soft enough so that it can be dug with light power equipment and is rippable by machinery.

[5] This item estimates the strength of soil materials as it applies to roadbeds. When available, AASHO Group Index values from laboratory tests were used; otherwise, the estimated Unified classes were used. The limitations were estimated assuming that the roads would be surfaced. On unsurfaced roads, rapidly drained, very sandy, poorly graded soils may cause washboard or rough roads.

[6] Group index values were estimated from information published by the Portland Cement Association (PCA, 1962) pp. 23-25.

[7] Downgrade to moderate if content of fines (less than 200 mesh) is greater than about 30 percent.

[8] P.I. means plasticity index.

[9] Frost heave is important where frost penetrates below the paved or hardened surface layer and moisture transportable by capillary movement is sufficient to form ice lenses at the freezing point. The susceptibility classes are taken from the United States Army Corps of Engineers (1962) pp. 5-8.

TABLE 16

Guide for assessing soil suitability for trench type sanitary landfills

The trench-type sanitary landfill is a sanitary landfill, in which dry garbage and trash is buried daily in an open trench and covered with a layer of soil material. Suitability of the site is dependent upon the potential for pollution of water sources through groundwater contact with the refuse, or leachate arising from the site. Those properties affecting ease of excavation of the site must be supplemented with geological and hydrological knowledge to provide subsurface soil and groundwater data to a depth of at least 3 to 4.5 m, a common depth of landfills.

Symbol[2]	Items Affecting Use	Degree of Soil Suitability			
		Good - G[3]	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal High Water Table	Not class determining if more than 180 cm		100-180 cm	<100 cm
w	Wetness[4]	Not class determining if better than imperfectly drained		Imperfectly drained	Poorly and very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional	Frequent
k	Permeability[5]	<5 cm/hr	<5 cm/hr	5-15 cm/hr	>15 cm/hr
t	Slope	0-15%	15-30%	30-45%	>45%
s	Soil Texture[4],[6] (dominant to a depth of 150 cm)	SL, L, SiL, SCL	SiCL[7], CL, SC, LS	SiC, C	Muck, peat, gravel, sand
d	Depth to Hard Bedrock Rippable	>150 cm >150 cm	>150 cm 100-150 cm	100-150 cm 100-150 cm	<100 cm <100 cm
p	Stoniness[4]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones <0.1 m apart (Class 5)
r	Nature of Bedrock	Impermeable			Highly permeable, fractured, easily soluble

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[1] Based on soil depth (120 cm) commonly investigated in making soil surveys.

[2] The symbols are used to indicate the nature of the limitation.

[3] If probability is high that the soil material to a depth of 3 to 4.5 m will not alter a rating of good or fair, indicate this by an appropriate footnote, such as "Probably good to a depth of 3.5 m", or "Probably fair to a depth of 3.5 m".

[4] For an explanation of stoniness, texture and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Reflects ability of soil to retard movement of leachate from the landfills; may not reflect a limitation in arid and semiarid areas.

[6] Reflects ease of digging and moving (workability) and trafficability in the immediate area of the trench where there may not be surfaced roads.

[7] Soils high in expansive clays may need to be given a suitability rating of poor.

TABLE 17

Guide for assessing soil suitability for area-type sanitary landfills

In the area-type sanitary landfill refuse is placed on the surface of the soil in successive layers. The daily and final cover material generally must be imported. A final cover of soil material at least 60 cm thick is placed over the fill when it is completed.

The soil under the proposed site should be investigated so as to determine the probability that leachates from the landfill can penetrate the soil and thereby pollute water supplies.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Seasonal Water Table[2]	> 150 cm	150-100 cm	50-100 cm	<50 cm
w	Wetness[2],[3]	Rapid to moderately well drained	Imperfectly drained	Poorly drained	Very poorly drained or permanently wet soils
i	Flooding	None	Rare	Occasional	Frequent
k	Permeability[4],[5]	Not class determining if less than 5 cm/hr		5-15 cm/hr	>15 cm/hr
t	Slope	0-9%	9-15%	15-30%	>30%

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[1] The symbols are used to indicate the nature of the limitation.

[2] Reflects influence of wetness on operation of equipment.

[3] For an explanation of drainage, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[4] Reflects ability of the soil to retard movement of leachate from landfills; may not reflect a limitation in arid and semiarid areas.

[5] Due to possible groundwater contamination, impermeable bedrock is considered poor and permeable bedrock is rated very poor for area-type sanitary landfills.

TABLE 18

Guide for assessing soil suitability as cover material for area-type sanitary landfills

The term cover material includes soil materials used to put a daily and final covering layer on refuse in area-type sanitary landfills. This cover material may be derived from the area of the landfill or may be brought in from surrounding areas.

Symbol[1/]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
u	Moist Consistence[2/]	Very friable, friable	Loose, firm	Very firm	Cemented
s	Texture[2/],[3/]	SL, L, SiL, SCL	SiCL, CL, SC, LS	SiC, C	Muck, peat, sand, gravel
d	Depth to bedrock[4/]	>150 cm	100-150 cm	50-100 cm	<50 cm
c	Coarse fragments[2/]	<15%	15-35%	>35%	
p	Stoniness[2/]	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones <0.1 m apart (Class 5)
t	Slope	<9%	9-15%	15-30%	>30%
w	Wetness[2/]	Not class determining if better than poorly drained		Poorly drained	Very poorly drained or permanently wet soils

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[1/] The symbols are used to indicate the nature of the limitation.

[2/] For an explanation of consistence, texture, coarse fragments, stoniness and soil drainage classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[3/] Soils having a high proportion of non-expansive clays may be given a suitability rating one class better than is shown for them in this table.

[4/] Thickness of material excluding topsoil, which will be stockpiled (see guide for topsoil).

TABLE 19

Guide for assessing soil suitability for reservoirs and sewage lagoons

Factors affecting the ability of undisturbed soils to impound water or sewage and prevent seepage are considered for evaluating soils on their suitability for reservoir and lagoon areas. This evaluation considers soil both as a vessel for the impounded area and as material for the enclosing embankment. As the impounded liquids could be potential sources of contamination of nearby water supplies, e.g. sewage lagoons, the landscape position of the reservoir as it affects risk of flooding must also be considered.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
h	Depth to Water Table[2]	>150 cm	100-150 cm	50-100 cm	<50 cm
i	Flooding[3]	None	None	Subject to infrequent flooding (once in 50 years)	Subject to frequent high level flooding
k	Soil Permeability	0-0.5 cm/hr	0.5-5 cm/hr	5-15 cm/hr	>15 cm/hr
t	Slope	0-2%	2-5%	5-9%	>9%
o	Organic Matter	<2%	2-10%	10-30%	>30%
c	Coarse Fragments[4] <25 cm in diameter, % by volume	<20%	20-35%	>35%	
p	Stoniness[4], >25 cm diameter, percent of surface area	<3% (Class 0, 1 and 2)	3-15% (Class 3)	15-50% (Class 4)	>50% (Class 5)
d	Depth to Bedrock[5]	>150 cm	100-150 cm	50-100 cm	<50 cm
j	Thickness of Slowly Permeable Layer	>100 cm	50-100 cm	50-25 cm	<25 cm
a	Subgrade Unified Soil Classes	GC, SC, CL, & CH	GM, ML, SM & MH	SW & SP	OL, OH & Pt GP, GW

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[1] The symbols are used to indicate the nature of the limitation.

[2] If the floor of the lagoon has nearly impermeable material at least 50 cm thick, disregard depth to water table.

[3] Disregard flooding if it is not likely to enter or damage the lagoon (flood waters have low velocity and depth less than 150 cm).

[4] For an explanation of coarse fragments and stoniness classes, see the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Surface exposures of non rippable rock are rated very poor. If underlying bedrock is impermeable, rating should be one class better.

TABLE 20

Guide for assessing soil suitability for septic tank absorption fields

This guide applies to soils to be used as an absorption and filtering medium for effluent from septic tank systems. A subsurface tile system laid in such a way that effluent from the septic tank is distributed reasonably uniformly into the natural soil is assumed when applying this guide. A rating of poor need not mean that a septic system should not be installed in the given soil, but rather, may suggest the difficulty, in terms of installation and maintenance, which can be expected.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
k	Permeability[2]	Rapid to moderately rapid	Moderate	Slow	Very slow
	Percolation Rate[3] (Auger hole method)	About 8-18 min/cm[3]	18-24 min/cm	Slower than 24 min/cm	
h	Depth to Seasonal Water Table[4]	>150 cm[5]	100-150 cm	50-100 cm	<50 cm
i	Flooding	Not subject to flooding	Not subject to flooding	Subject to occasional flooding (once in 5 years)	Floods every year
t	Slope	0-9%	9-15%	15-30%	>30%
d	Depth to Hard Rock, bedrock or other impervious materials	>150 cm	100-150 cm[6]	50-100 cm	<50 cm

[1] The symbols are used to indicate the nature of the limitation.

[2] The suitability ratings should be related to the permeability of soil layers at and below depth of the tile line.

[3] Soils having a percolation rate less than about 8 min/cm are likely to present a pollution hazard to adjacent waters. This hazard must be noted, but the degree of hazard must, in each case, be assessed by examining the proximity of the proposed installation to water bodies, water table, and related features. The symbol g is used to indicate this condition. Refer to U.S. Dept. of Health, Education and Welfare (1969) for details of this procedure.

[4] Seasonal means for more than one month. It may, with caution, be possible to make some adjustment for the severity of a water table limitation in those cases where seasonal use of the facility does not coincide with the period of high water table.

[5] A seasonal water table should be at least 100 cm below the bottom of the trench at all times for soils rated Good (U.S. Dept. of Health, Education and Welfare, 1969). The depths used to water table are based on an assumed tile depth of 50 cm. Where relief permits, the effective depth above a water table or rock can be increased by adding appropriate amounts of fill.

[6] Where the slope is greater than 9%, a depth to bedrock of 100-150 cm is assessed as poor.

TABLE 21

Guide for assessing soil suitability for playgrounds

This guide applies to soils to be used intensively for playgrounds for baseball, football, badminton, and for other similar organized games. These areas are subject to intensive foot traffic. A nearly level surface, good drainage, and a soil texture and consistence that gives a firm surface generally are required. The most desirable soils are free of rock outcrops and coarse fragments.

Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Rapidly, well and moderately well drained soils with no ponding or seepage. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding of short duration and imperfectly drained soils. Water table below 50 cm during season of use.	Imperfectly drained soils subject to seepage or ponding, and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None during season of use.	Occasional flooding. May flood once every 2-3 years during season of use.	Floods every year during season of use.	Prolonged flooding during season of use.
k	Permeability	Very rapid to moderate.	Moderately slow and slow.	Very slow.	
t	Slope	0-2%	2-5%	5-9%	>9%
d	Depth to Bedrock	>100 cm	50-100 cm[3]	<50 cm[3]	
c	Coarse fragments on surface[2]	Relatively free of coarse fragments.	<20% coarse fragments.	>20% coarse fragments.	
p	Stoniness[2]	Stones >10 m apart. (Class 0 to 1)	Stones 2-10 m apart. (Class 2)	Stones 0.1-2 m apart. (Class 3, 4)	Stones <0.1 m apart. (Class 5)
r	Rockiness[2]	Rock exposures >100 m apart and cover <2% of the surface.	Rock exposures 30-100 m apart and cover about 2-10% of the surface.	Rock exposures <30 m apart and cover >10% of the surface.	Rock outcrops too frequent to permit playground location.
s	Surface Soil Texture[2],[4]	SL, FSL, VFSL, L	SiL, CL, SCL, SiCL, LS	SC, SiC, C[5]; S, Si	Peaty soils; S and LS subject to blowing.
q	Depth to Sand or Gravel[6]	>100 cm	50-100 cm	<50 cm	
m	Useful Moisture[7]	Water storage capacity[8] >15.0 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5-15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] <7.5 cm and/or low rainfall and/or high evapotranspiration.	

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[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).
Coarse fragments for the purpose of this table include gravels and cobbles.

[3] Downgrade to a very poor suitability rating if the slope is greater than 5%.

[4] Surface soil texture influences soil ratings as it affects foot trafficability, surface wetness, dust, and maintenance. Adverse soil textures may be partially or completely overcome with the addition of topsoil.

[5] Moderately well and well drained SC, SiC and C soils may be rated fair.

[6] Depth to sand or gravel is considered a limitation in that levelling operations may expose sand or gravel, thereby bringing about adverse surface textures and undesirable amounts of coarse fragments. The addition of topsoil after the levelling process would overcome this limitation.

[7] This item attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

[8] Consult glossary for definitions of terms used.

TABLE 22

Guide for assessing soil suitability for picnic areas

This guide applies to soils considered for intensive use as park-type picnic areas. It is assumed that most vehicular traffic will be confined to the access roads. Soil suitability for growing and maintaining vegetation is not a part of this guide, except as influenced by moisture, but is an important item to consider in the final evaluation of site.

Symbol[1]	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness[2]	Very rapidly, rapidly, well and moderately well drained soils not subject to seepage or ponding. Water table below 50 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding and imperfectly drained soils not subject to ponding or seepage. Water Table above 50 cm for short periods during season of use.	Imperfectly drained soils subject to seepage or ponding. Poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Very poorly drained and permanently wet soils.
f	Flooding	None during season of use.	May flood 1 or 2 times per year for short periods during season of use.	Floods more than 2 times during season of use.	Prolonged flooding during season of use.
t	Slope	0-9%	9-15%	15-30%	>30%
s	Surface Soil Texture[2],[3]	SL, FSL, VFSL, L	SiL, CL, SCL, SiCL, LS, and sand other than loose sand.	SC, SiC, C[4]; Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface[2]	0-20%	20-50%	>50%	
p	Stoniness[2]	Stones >2 m apart (Class 0 to 2)	Stones 1-2 m apart (Class 3)	Stones 0.1-1 m apart (Class 4)	Stones <0.1 m apart (Class 5)
r	Rockiness[2],[5],[6]	Rock exposures roughly 30-100 or more m apart and cover <10% of the surface.	Rock exposures roughly 10-30 m apart and cover 10-25% of the surface.	Rock exposures <10 m apart and cover >25% of the surface.	Rock exposures too frequent to permit location of picnic areas.
m	Useful Moisture[7]	Water storage capacity[8] >15 cm and/or adequate rainfall and/or low evapotranspiration.	Water storage capacity[8] 7.5-15 cm and/or moderate rainfall and/or moderate evapotranspiration.	Water storage capacity[8] <7.5 cm and/or low rainfall and/or high evapotranspiration.	

[1] The symbols are used to indicate the nature of the limitation.

[2] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978). Coarse fragments for the purpose of this table, include gravels and cobbles. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.

[3] Surface soil texture influences soil ratings as it affects foot trafficability, dust and soil permeability.

[4] Moderately well and well drained SC, SiC and C soils may be rated fair.

[5] Very shallow soils are rated as having severe or very severe limitations for stoniness or rockiness.

[6] The nature and topography of the bedrock exposures may significantly alter these ratings. As such, on-site investigations will be necessary in map units containing bedrock when these are considered as possible sites.

[7] This item attempts to evaluate the adequacy of moisture for vegetative growth. It incorporates the concept of supply through rainfall, loss through evapotranspiration, and storage within the rooting zone. In soils where the water table is within rooting depth for a significant portion of the year, water storage capacity may not significantly influence vegetation growth.

[8] Consult glossary for definitions of terms used.

TABLE 23

Guide for assessing soil suitability for camp areas

This guide applies to soils to be used intensively for tents and camp trailers and the accompanying activities of outdoor living. It is assumed that little site preparation will be done other than shaping and levelling for campsites and parking areas. The soil should be suitable for heavy foot traffic by humans and limited vehicular traffic. Soil suitability for growing and maintaining vegetation is not a part of this guide, but is an important item to consider in the final evaluation of site.

Back country campsites differ in design, setting and management but require similar soil attributes. These guides should apply to evaluations for back country campsites but depending on the nature of the facility the interpreter may wish to adjust the criteria defining a given degree of limitation to reflect the changed requirement. For example, small tentsites may allow rock exposures greater than 10 m apart to be considered a slight limitation.

Symbol 1/	Items Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
w	Wetness 2/	Very rapidly, rapidly, well and moderately well drained soils with no seepage or ponding. Water table below 75 cm during season of use.	Moderately well drained soils subject to occasional seepage or ponding and imperfectly drained soils with no seepage or ponding. Water table below 50 cm during season of use.	Imperfectly drained soils subject to seepage or ponding and poorly drained soils. Water table above 50 cm during season of use.	Very poorly drained and permanently wet soils.
i	Flooding	None	Very occasional flooding during season of use. Once in 5-10 years.	Occasional flooding during season of use. Once in 2-4 years.	Flooding during every season of use.
k	Permeability	Very rapid to moderate inclusive.	Moderately slow and slow.	Very slow.	
t	Slope	0-9%	9-15%	15-30%	>30%
s	Surface Soil Texture 2/,3/	SL, FSL, VFSL, L	SiL, SCL, CL, SiCL, LS, and sand other than loose sand.	SC, SiC, C 4/; Si	Peaty soils; loose sand subject to blowing.
c	Coarse Fragments on Surface 2/,5/	0-20%	20-50%	>50%	
p	Stoniness 2/,6/	Stones >10 m apart (Class 0 and 1)	Stones 2-10 m apart (Class 2)	Stones 0.1-2 m apart (Class 3 and 4)	Stones < 0.1 m apart (Class 5)
r	Rockiness 2/,6/	No rock exposures	Rock exposures >10 m apart and cover <25% of the area.	Rock exposures <10 m apart and cover >25% of the area.	Rock exposures too frequent to permit campground location.

1/ The symbols are used to indicate the nature of the limitation.

2/ See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

3/ Surface soil texture influences soil ratings as it affects foot trafficability, dust, and soil permeability.

4/ Moderately well and well drained SC, SiC and C soils may be rated fair.

5/ Coarse fragments for the purpose of this table include gravels and cobbles. Some gravelly soils may be rated as having slight limitations if the content of gravel exceeds 20% by only a small margin, providing (a) the gravel is embedded in the soil matrix, or (b) the fragments are less than 2 cm in size.

6/ Very shallow soils are rated as having a limitation for rockiness and/or stoniness.

TABLE 24

Guide for assessing soil suitability for paths and trails

It is assumed that the trails will be built at least 45 cm wide and that obstructions such as cobbles and stones will be removed during construction. It is also assumed that a dry, stable tread is desirable and that muddy, dusty, worn or eroded trail treads are undesirable. Hiking and riding trails are not treated separately, but as the design requirements for riding trails are more stringent, a given limitation will be more difficult to overcome. Poor or very poor suitability does not indicate that a trail cannot or should not be built. It does, however, suggest higher design requirements and maintenance to overcome the limitations.

Symbol[1]	Items[2] Affecting Use	Degree of Soil Suitability			
		Good - G	Fair - F	Poor - P	Very Poor - V
s	Texture[3],[4]	SL, FSL, VFSL, LS, L	SiL, CL, SiCL, SCL	SC, SiC, C[5]; Sand, Si	Peaty soils; loose sand subject to blowing
c	Coarse Fragment Content[4],[6]	0-20%	20-50%	>50%	
p	Stoniness[4]	Stones >2 m apart (Class 0 to 2)	Stones 1-2 m apart (Class 3)	Stones 0.1-1 m apart (Class 4)	Stones <0.1 m apart (Class 5)
w	Wetness[4]	Very rapidly, rapidly well, and moderately well drained soils. Water table below 50 cm during season of use.	Moderately well drained soils subject to occasional seepage and ponding and imperfectly drained soils. Water table may be above 50 cm for short periods during season of use.	Poorly and very poorly drained soils. Water table above 50 cm and often near surface for a month or more during season of use.	Permanently wet soils.
r	Rockiness[4],[7]	Rock exposures >30 m apart and cover <10% of the surface.	Rock exposures 10-30 m apart and cover 10-25% of the surface.	Rock exposures <10 m apart and cover >25% of the surface.	Rock exposures too frequent to permit location of paths and trails.
t	Slope[8]	0-15%	15-30%	30-60%	>60%
i	Flooding	Not subject to flooding during season of use.	Floods 1 or 2 times during season of use.	Floods more than 2 times during season of use.	Subject to prolonged flooding during season of use.

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[1] The symbols are used to indicate the nature of the limitation.

[2] The items affecting use listed in this table are those which have been shown to cause significant differences in trail response. Elevation, aspect, position on slope, and snow avalanching may have slight affects or influence trail management and should be considered in the final site evaluation. Items such as vegetation, fauna, and scenic value are not considered in the guidelines (Epp, 1977).

[3] Texture refers to the soil texture which will form the tread texture. This is the surface texture on level areas but may be a subsurface texture on slopes. Textural classes are based on the less than 2 mm soil fraction. Texture influences soil ratings as it influences foot trafficability, dust, design or maintenance of trails, and erosion hazards.

[4] See also definitions for coarse fragments, rockiness, stoniness, textural and soil drainage classes in the Manual for Describing Soils in the Field (Canada Soil Survey Committee, 1978).

[5] Moderately well and well drained SC, SiC and C soils may be rated fair.

[6] Coarse fragments for the purpose of this table, include gravels and cobbles. Gravels tend to cause unstable footing when present in high amounts, and are also associated with increased erosion. Cobbles (and stones) must be removed from the trail tread, increasing construction and maintenance difficulties. Some gravelly soils may be rated as having a slight limitation if the content of gravel exceeds 20% by only a small margin providing (a) the gravel is embedded in the soil matrix or (b) the fragments are less than 2 cm in size.

[7] The type of rock outcrop (flat lying vs cliffs), and the orientation of the structure (linear cliffs vs massive blocks) can greatly alter the degree of the limitation. Each site with a Rockiness limitation based on the percent rock outcrop above should be evaluated on its own merits and the degree of limitation should then be modified appropriately if necessary.

[8] Slope in this context refers to the slope of the ground surface, not the slope of the tread.

Appendix E

CORRELATION OF THE SOIL SERIES DESCRIPTIONS FROM THE SOIL SURVEY OF THE RURAL MUNICIPALITY OF SOUTH NORFOLK

The detailed and semi-detailed resurvey of the Rural Municipality of South Norfolk replaces portions of the reconnaissance soil surveys of South-Central Manitoba (1943) and the Carberry Map Sheet Area (1957). This resurvey benefits from more intensive field examination of soils and larger map scale formats which permit the delineation of more soil detail not possible on reconnaissance (1:126,720 scale) soil maps.

The reconnaissance mapping utilized broadly defined soil groupings called "Soil Associations" consisting of related but unlike soils which occur in characteristic landscape patterns on similar parent material. These related soils, called "soil associates" occupy different positions in the landscape and differ in profile because of local influences of topography, drainage and vegetation. Individual soil associates can occupy large continuous land areas, but more commonly occupy small areas and occur in complex patterns with other associates.

Soil associates that have similar profile characteristics but vary in some physical feature important to agricultural use, are classified as phases of associates. Recognition of soil phases is based on such external features as topography, stoniness or the presence of an unconforming subsurface parent material characteristic. These phases are now recognized as phases of soil series or are of significant extent and importance to be classified as separate soil series.

A taxonomic classification unit approximately equivalent to soil associates called "soil series" is used in the resurvey as the basic taxonomic unit and as the map delineation identifier. In general, the allowable range in variation of soil profile characteristics is significantly less than the range permitted in the description of soil associates. A comparison of presently defined soil series with soil associations, soil associates and phases described in the Carberry Map Sheet Area Report No. 7) or the South-Central Manitoba (Report No. 25) Soil Reports is presented in Table 4.

Table 25. Correlation of the Soil Series Descriptions from the Soil Survey of the Rural Municipality of South Norfolk with the Soil Association Descriptions from the South-Central (1943) and Carberry (1957) Reconnaissance Soil Surveys

Soil Symbol	Soil Series Name	South-Central Manitoba(1943) Soil Association	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
AIZ	Arizona	Stockton, loamy sand	Stockton, loamy sand	Rapidly drained, eroded knolls in the Stockton Association
ARN	Aronet	Almasippi sand	Almasippi, sand	Minor wind-blown inclusions of the Almasippi Association. Mainly in fence rows.
ASB	Assiniboine	Assiniboine Complex	Assiniboine Complex	Imperfectly drained, dominantly clayey inclusions of the Assiniboine Complex.
ASS	Almasippi	Almasippi, sand	Almasippi, sand	Imperfectly drained, Clacareous Black associates of the Almasippi Association.
ASZ	Agassiz	Agassiz	Agassiz	Well drained, Blackearth associates of the Agassiz Association.
ATN	Altamont	Altamont		Well drained, gray-black soils of the Altamont Association.
BIP	Bishop	Benton		Imperfectly drained Black Meadow associates of the Benton Association
BKA	Birkenhead	Agassiz	Agassiz	Excessively drained, clacareous inclusions of the Blackearth associates in the Agassiz Association.
BKR	Basker	Assiniboine Complex	Assiniboine Complex	Poorly drained, loamy associates of the extremely variable Assiniboine Complex.
BMG	Blumengart	Gretna		Imperfectly drained, immature associates of the Gretna Association.
BNE	Bone		Firdale	Imperfectly drained, very fine sandy loam textured, Degraded Black associates of the Firdale Association.
BNF	Blumenfeld	Gretna	Rathwell	Poorly drained, Calcareous Meadow associates of the Gretna and Rathwell Associations.
BUM	Blumenort	Gretna		Poorly drained, Calcareous Meadow associates of the Gretna Association
CAV	Carvey	Agassiz	Agassiz	Poorly drained, Calcareous Meadow associates of the Agassiz Association with a loamy lacustrine veneer.
CCS	Cactus	Stockton	Stockton	Rapidly drained Blackearth associates of the Stockton Association.
CKD	Crookdale		Wellwood	Imperfectly drained, clay loam textured, Black Meadow associates of the Wellwood Association.
CYN	Croyon	Agassiz	Agassiz	Well drained, Blackearth inclusions of the Agassiz Association with a loamy surface veneer.
CYN1	Croyon, shaly variant			
CYN2	Croyon, sandy variant			
CTZ	Chortitz		Assiniboine Complex	Imperfectly drained, loamy associates of the Assiniboine Complex.
CXT	Capell	Agassiz	Agassiz	Imperfectly drained, inclusions of the Agassiz Association with a loamy surface veneer.
CXT1	Capell, shaly variant			
CXV	Charman	Holland	Holland	Imperfectly drained, Black Meadow associates of the Holland Association.
DGF	Darlingford	Darlingford		Well drained, Blackearth associates of the Darlingford Association.
DGS	Dugas		Rathwell	Equivalent to Horndean Complex in the Morris Report(1953). Rathwell Association with light textured substrate is closest equivalent in the map area. Imperfectly drained Calcareous Black Meadow associate
DHO	Deadhorse		Rathwell	No equivalent association in South-Central or Carberry Reports. Imperfectly drained, Calcareous Black Meadow associates of the Horndean Complex in the Morris Map Sheet Area(1953). Closest equivalent in the map area is the heavy textured associates of the Rathwell Association.

Table 25 cont'd

Soil Symbol	Soil Series Name	South-Central Manitoba(1943) Soil Association	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
DLN	Danlin		Firdale	Imperfectly drained, Degrading Black Meadow associates of the Firdale Association.
DNH	Denham	Altona, fine loam, heavy substrate	Rathwell	Well drained, Blackearth associates of the Rathwell and Altona fine loam Associations.
DOB	Dobbin	Stockton	Stockton, fine sandy loam	Well drained, Degrading Black associates of the Stockton Association
DOT	Dorset	Marringhurst, Agassiz	Marringhurst, Agassiz	Well drained, Blackearth associates of the Marringhurst and Agassiz Associations.
DRN	Durnan	Holland	Holland	Well drained, Blackearth associates of the Holland Association.
DXM	Druxman	Agassiz	Agassiz	Imperfectly drained, Black Meadow associates of the Agassiz Association with a thin, loamy surface veneer.
DXT	Dexter	Agassiz, Marringhurst	Agassiz, Marringhurst	Imperfectly drained, Black Meadow associates of the Agassiz and Marringhurst Associations.
DZW	Dezwood	Pembina		Well drained, Degraded Black associates of the Pembina Association.
EDK	Edkins	Altona, fine loam, heavy substrate	Rathwell	Poorly drained, Meadow associates of Rathwell and Altona fine loam, heavy substrate phase Associations.
EEK	Elm Creek		Almasippi, clay substrate	Imperfectly drained, Black Meadow associates of the Almasippi Association with a clay substrate.
EGF	Eigenhof		Rathwell	Well drained, Blackearth associates of the Rathwell Association.
EMV	Elm River		Assiniboine Complex	Moderately well to imperfectly drained, loamy to sandy, immature associates of the Assiniboine Complex.
EMV1	Elm River, sandy variant			
ERX	Eroded Slopes Complex	Eroded Slopes	Eroded Slopes	Eroded slope channels along the Manitoba Escarpment.
FFR	Fifere	Pembina		Well drained, shale till, Degraded Black associates of the Pembina Association.
FIR	Firdale		Firdale	Well drained, Degraded Black associates of the Firdale Association.
FND	Fairland	Holland	Holland	Well drained, loamy, Blackearth associates of the Holland Association.
FTN	Fortina	Marringhurst	Marringhurst	Poorly drained, Meadow associates of the Marringhurst Association.
FRS	Ferris	Darlingford		Imperfectly drained, Calcareous Black Meadow associates of the Darlingford Association.
GBO	Glenboro	Glenboro	Glenboro	Well drained, Blackearth associates of the Glenboro Association. Also is inclusion of Holland-Stockton Complex in the Carberry Map Sheet.
GDH	Gnadenthal		Rathwell	Imperfectly drained, loamy, Calcareous Black Meadow associate of the Rathwell Association.
GRO	Grover	Glenboro	Glenboro	Imperfectly drained, Black Meadow associates of the Glenboro Association. Also occurs in the Holland-Stockton Complex of the Carberry Map Sheet.
GRR	Guerra	Altamont		Poorly drained, Meadow soils associated with Blackearths in the Altamont Association.
GTD	Gateside	Holland	Holland	Imperfectly drained, Black Meadow associates of the Holland Association.
GVS	Gervais		Assiniboine Complex	Imperfectly drained, immature, loamy associates of the Assiniboine Complex.

Table25.cont'd

Soil Symbol	Soil Series Name	South-Central Manitoba(1943) Soil Association	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
GYS	Grayson	Glenboro	Glenboro	Poorly drained, Meadow associates of the Glenboro Association. Also occurs in the Holland-Stockton Complex of the Carberry Map Sheet.
GYV	Graysville	Altona, fine loam, heavy substrate	Rathwell	Imperfectly drained, Calcareous Black Meadow associates of the Rathwell and Altona, heavy substrate phase Associations.
HAT	Halstead		Firdale	Well drained, coarse loamy, Degraded Black associates of the Firdale Association.
HEB	Hebbot	Darlingford		Well drained, Calcareous Black associates of the Darlingford Association.
HHF	Hochfeld		Almasippi, loamy sands	Well drained, Blackearth associates of the Almasippi loamy sand Association.
HIN	Hibsin		Almasippi, clay substrate	Well drained, Blackearth associates of the Almasippi clay substrate Association.
HMO	Hummerston	Stockton	Stockton	Imperfectly drained, Calcareous Black Meadow associates of the Stockton Association.
HOS	Horose	Pembina		Poorly drained, Meadow associates of the Pembina Association.
JIK	Janick		Harding, clay	Well drained, Blackearth associates of the Harding Association.
JST	Jasset		Almasippi, loamy sands	Imperfectly drained, Black Meadow associates of the Almasippi Association.
JYL	Joyale	Altamont		Imperfectly drained, Calcareous Black Meadow associates of the Altamont Association.
KIS	Kingsley	Altamont		Well drained, Gray-Wooded associates of the Altamont Association.
KOT	Kronstal		Almasippi, loamy sands	Imperfectly drained, Black Meadow associates of Almasippi loamy sands Association.
KRN	Kronstal		Almasippi, loamy sands	Imperfectly drained, Black Meadow associates of Almasippi loamy sands Association.
KUD	Knudson	Altamont	Harding clay, till substrate	Well drained, Blackearth associates of the Altamont and Harding, till-substrate Associations.
LAY	Layland		Almasippi, clay substrate	Poorly drained, Meadow associates of the Almasippi, clay substrate Association.
LEI	Levine	Assiniboine Complex	Assiniboine Complex	Imperfectly drained, immature associates of the Assiniboine Complex.
LEW	Loewen	Assiniboine Complex	Assiniboine Complex	Poorly drained, immature associates of the Assiniboine Complex
LLT	Lelant	Almasippi	Almasippi sand	Poorly drained, Meadow associates of the Almasippi Association.
LOP	Long Plain	Almasippi	Almasippi sand	Imperfectly drained, immature associates of the Almasippi Association
LRY	Leary	Leary		Rapidly drained, Degraded Black associates of the Leary Association.
LSL LSL1	La Salle La Salle, sandy variant		Assiniboine Complex	Well drained, loamy, immature associates of the Assiniboine Complex.
MFI MFI1	Mansfield Mansfield, shaly variant	Marringhurst, Agassiz	Marringhurst, Agassiz	Imperfectly drained, Black Meadow associates of the Marringhurst and Agassiz Associations.
MKY	Mockry	Stockton	Stockton	Poorly drained, Meadow soils associated with immature soils of the Stockton Association.
MRH	Marringhurst	Marringhurst, Agassiz	Marringhurst, Agassiz	Rapidly drained, Calcareous Blackearth associates of the Marringhurst and Agassiz Associations.
NBG	Neuenberg		Almasippi, loamy sands	Imperfectly drained, Calcareous Black Meadow associates of the Almasippi loamy sands Association.

Table25.cont'd

Soil Symbol	Soil Series Name	South-Central Manitoba(1943) Soil Association	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
NSH	Narish	Altamont		Poorly drained, Meadow associates of the Altamont Association.
NUH	Neuhorst		Rathwell	Imperfectly drained, fine loamy, Calcareous Black Meadow associates of the Rathwell Association.
NWN	Newton Siding		Rathwell	Equivalent to Horndean Complex in the Morris Report(1953). Rathwell Association with sandy substrate is closest equivalent in the map area. Imperfectly drained Black Meadow associates of the Rathwell Association.
NYO	Nayler	Pembina		Well drained, shale till, Gray-Wooded associates of the Pembina Association.
OAY	Oakley	Pembina		Well drained, Gray-Wooded associates of the Pembina Association over shale bedrock.
OBO	Osborne		Red River	Poorly drained, Meadow associates of the Red River Association.
ONH	Onahan	Stockton	Stockton	Imperfectly drained, immature associates of the Stockton Association
OWK	Osterwick		Almasippi, loamy sands	Poorly drained, Meadow associates of the Almasippi loamy sands Association.
PBI PBI1	Pembina Pembina, loamy substrate	Pembina		Well drained, Gray-Wooded associates of the Pembina Association.
PDA	Prodan	Holland	Holland	Imperfectly drained, Calcareous Black Meadow associates of the Holland Association.
PER	Perillo	Meadow-Marsh	Marsh and Peaty Meadow	Very poorly drained, organic associates of many associations but dominantly the Stockton and Almasippi Associations.
PLE	Pleasant	Holland	Holland	Imperfectly drained, Black Meadow associates of the Holland Association
PME	Plum Coulee		Rathwell	Imperfectly drained, Black Meadow associates of the Horndean Complex of the Morris Map Sheet(1953) are equivalent to the Plum Coulee Series. The closest equivalent in the map area is the heavy texture associates of the Rathwell Association.
POX	Poolex	Holland	Holland	Poorly drained, Meadow associates of the Holland Association.
PPR	Poplar Point	Assiniboine Complex	Assiniboine Complex	Imperfectly drained, immature associates of the Assiniboine Complex.
PTR	Petrel	Glenboro	Glenboro	Imperfectly drained, Black Meadow associates of the Glenboro Association.
RAM	Ramada	Holland	Holland	Well drained, Blackearth associates of the Holland Association.
RBK	Rosebank		Almasippi, clay substrate	Imperfectly drained, Clacareous Black Meadow associates of the Almasippi clay substrate Association.
RFD	Reinfeld		Rathwell	Well drained, Blackearth associates of the Rathwell Association.
RGD	Rignold	Altona, fine loam, heavy substrate	Rathwell	Imperfectly drained, Black Meadow associates of the Altona and Rathwell Associations.
RMP	Rempel	Holland	Holland	Well drained, Calcareous Black associates of the Holland Association
RSG	Rosengart		Almasippi, loamy sands	Well drained, Blackearth associates of the Almasippi Association.
RWL	Rathwell		Rathwell	Imperfectly drained, Black Meadow associates of the Rathwell Association.
SCK	Stockton	Stockton, sandy loam	Stockton, loamy sand	Well drained, Blackearth associates of the Stockton Association.
SEE	Sewell	Stockton, sandy loam	Stockton, loamy sand	Poorly drained, Blackearth associates of the Stockton Association.
SEU	Shellmouth Complex	Eroded Slopes and Channels	Eroded Slopes	Eroded slopes along the Manitoba Escarpment and stream channels.
SHX	Shilox	Stockton, sands	Stockton, loamy sands	Rapidly drained, immature associates of the Stockton Association.

Table 25.cont'd

Soil Symbol	Soil Series Name	South-Central Manitoba(1943) Soil Association	Carberry Map Sheet(1957) Soil Association	The Named Soil Series Correlates with...
SKL	Skelding	Almasippi, sand	Almasippi, sand	Rapidly drained, immature associates of the Almasippi Association.
SQR	Squirrel Creek	Altona, fine loamy, heavy substrate	Rathwell	Imperfectly drained, Calcareous Black Meadow associates of the Altona and Rathwell Associations.
SUE	St. Claude		Almasippi, loamy sands	Imperfectly drained, Calcareous Black Meadow associates of the Almasippi Association.
TAV	Traverse	Holland	Holland	Well drained, loamy, Calcareous Black associates of the Holland Association.
TDP	Tadpole	Holland	Holland, Firdale	Poorly drained, fine loamy, Meadow associates of the Holland or Firdale Association.
TGR	Taggart	Holland	Holland	Imperfectly drained, loamy, Calcareous Black Meadow associates of the Holland Association.
TLI	Tellier	Altamont		Imperfectly drained, Degraded Black Meadow associates of the Altamort Association.
TOC	Torcan	Holland	Holland	Imperfectly drained, Black Meadow associates of the Holland Association.
TNT TNT1	Trinton Trinton, shaly variant	Leary		Well drained, Gray-Wooded associates of the Leary Association with a loamy surface mantle.
VDL VDL1	Vandal Vandal, shaly variant	Leary		Well drained, Degraded Black associates of the Leary Association with a loamy surface veneer.
VDS	Vordas	Holland	Holland	Poorly drained, loamy, Meadow associates of the Holland Association.
VTL VTL1	Vartel Vartel, shaly variant	Leary		Imperfectly drained, Degraded Black Meadow associates of the Leary Association with a loamy surface veneer.
WHL	Wheatland	Marringhurst, Agassiz	Marringhurst, Agassiz	Well drained, Blackearth associates of the Marringhurst and Agassiz Associations with a sandy surface mantle.
WIK	Winkler		Rathwell	Well drained, Blackearth associates of the Horndean Complex from the Morris Map Sheet (1953). Clayey, Rathwell associates are the nearest equivalent in the South Norfolk map area.
WWB	Willowbend	Assiniboine Complex	Assiniboine Complex	Poorly drained, loamy, immature associates of the Assiniboine Complex
WWC	Willowcrest	Almasippi	Almasippi	Imperfectly drained, Black Meadow associates of the Almasippi Association.
WWD	Wellwood	Glenboro	Glenboro	Well drained, Blackearth associates of the Glenboro Association with a fine loamy surface mantle.
XVI	Xavier	Meadow-Marsh	Marsh and Peaty Meadow	Very poorly drained, deep organic soils.

Appendix F

SOUTH NORFOLK: INDEX MAP, SOIL MAP LEGEND AND MAP SYMBOLOGY

Soil Legend for SOUTH NORFOLK

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
ASS	Almasippi	LFS	IMPER	Lacustrine	Sandy	GLR.BL
ASB	Assiniboine	SIC	IMPER	Fluvial	Clayey	GLCU.R
AIZ	Arizona	LFS	WELL	Lacustrine	Sandy	O.R
ASZ	Agassiz	LS	WELL	Glaciofluvial	Sandy Skeletal	O.BL
ARN	Aronet	LFS	WELL	Eolian	Sandy	CU.R
ATN	Altamont	CL	WELL	Lacustrine/Till	Fine Loamy	O.DG
BKA	Birkenhead	LS	M.WELL	Fluviolacustrine	Sandy Skeletal	CA.BL
BNE	Bone	VFSL	IMPER	Lacustrine	Coarse Loamy	GL.DG
BNF	Blumenfeld	L	POOR	Lacustrine	Loamy	R.HG
BUM	Blumenort	C	POOR	Fluviolacustrine	Clayey	R.HG
BKR	Basker	SICL	POOR	Fluvial	Loamy	R.HG
BIP	Bishop	C	IMPER	Residual,Till/Shale	Clayey/Shale	GLR.BL
BMG	Blumengart	C	IMPER	Fluviolacustrine	Clayey	GLCU.R
CYN	Croyon	L-CL	WELL	Lacustrine/Fluvial	Loamy/Sandy Skeletal	O.BL
CYN1	Croyon,Shaly Variant	L-CL	WELL	Lacustrine/Fluvial	Loamy/Sandy Skeletal	O.BL
CYN2	Croyon,Sandy Variant	L-CL	WELL	Lacustrine/Fluvial	Loamy/Sandy	O.BL
CXT	Capell	CL	IMPER	Lacustrine/Fluvial	Fine Loamy/Sandy Skeletal	GLR.BL
CXT1	Capell Shaly Variant	CL	IMPER	Lacustrine/Fluvial	Fine Loamy/Sandy Skeletal	GLR.BL
CXV	Charman	CL	IMPER	Lacustrine	Fine Loamy	GL.BL
CTZ	Chortitz	CL	IMPER	Fluvial	Loamy	GLCU.R
CAV	Carvey	CL	POOR	Lacustrine/Fluvial	Loamy/Sandy Skeletal	R.HG
CAV1	Carvey Shaly Variant	CL	POOR	Lacustrine/Fluvial	Fine Loamy/Sandy Skeletal	R.HG
CCS	Cactus	LFS	WELL	Lacustrine	Sandy	R.BL
CKD	Crookdale	CL	IMPER	Lacustrine	Fine Loamy/Sandy	GLR.BL
DOB	Dobbin	FS	WELL	Lacustrine	Sandy	O.DG
DOT	Dorset	LS	WELL	Fluvial	Sandy Skeletal	O.BL
DHO	Deadhorse	C	IMPER	Lacustrine	Clayey	GLR.BL
DGS	Dugas	C	IMPER	Lacustrine	Clayey/Loamy	GLR.BL
DZW	Dezwood	L	WELL	Till	Fine Loamy	O.DG
DRN	Durnan	L	WELL	Lacustrine	Loamy	R.BL

Soil Legend for SOUTH NORFOLK

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
DGF	Darlingford	CL	WELL	Till	Fine Loamy	O.BL
DXM	Druxman	L-CL	IMPER	Lacustrine/Fluvial	Loamy/Sandy Skeletal	GL.BL
DXT	Dexter	LS	IMPER	Fluvial	Sandy Skeletal	GL.BL
DLN	Danlin	CL	IMPER	Lacustrine	Fine Loamy	GL.DG
DNH	Denham	L	WELL	Lacustrine	Loamy/Clayey	O.BL
EGF	Eigenhof	CL	WELL	Lacustrine	Fine Loamy	O.BL
EEK	Elm Creek	FSL	IMPER	Lacustrine	Sandy/Clayey	GL.BL
EDK	Edkins	L	POOR	Lacustrine	Loamy/Clayey	R.HG
EMV	Elm River	SICL	M.WELL	Fluvial	Loamy	CU.R
EMV1	Elm River,Sandy Var.	LFS	M.WELL	Fluvial	Sandy	CU.R
FIR	Firdale	SICL	WELL	Lacustrine	Fine Loamy	O.DG
FFR	Fifere	L	WELL	Till	Fine Loamy	O.DG
FND	Fairland	L	WELL	Lacustrine	Loamy	O.BL
FTN	Fortina	SL	POOR	Fluviolacustrine	Sandy Skeletal	R.HG
FRS	Ferris	CL	IMPER	Till	Fine Loamy	GLR.BL
GDH	Gnadenthal	L	IMPER	Lacustrine	Loamy	GLR.BL
GYV	Graysville	L	IMPER	Lacustrine	Loamy/Clayey	GLR.BL
GRO	Grover	L	IMPER	Lacustrine	Loamy/Sandy	GLR.BL
GRR	Guerra	CL	POOR	Lacustrine/Till	Fine Loamy	R.HG
GBO	Glenboro	L	WELL	Lacustrine	Loamy/Sandy	O.BL
GYS	Grayson	L	POOR	Lacustrine	Loamy/Sandy	R.HG
GTD	Gateside	FSL	IMPER	Lacustrine	Coarse Loamy	GL.BL
GVS	Gervais	SICL	IMPER	Fluvial	Loamy	GLCU.R
HAT	Halstead	VFSL	WELL	Lacustrine	Coarse Loamy	O.DG
HEB	Hebbot	CL	WELL	Till	Fine Loamy	R.BL.
HOS	Horose	CL	POOR	Till	Fine Loamy	R.HG
HIN	Hibsin	FSL	M.WELL	Lacustrine	Coarse Loamy/Clayey	O.BL
HMO	Hummerston	LFS	IMPER	Lacustrine	Sandy	GLR.BL
HHF	Hochfeld	FSL	M.WELL	Lacustrine	Coarse Loamy	O.BL
JYL	Joyale	CL	IMPER	Lacustrine/Till	Fine Loamy	GLR.BL

Soil Legend for SOUTH NORFOLK

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
JST	Jasset	VFSL	IMPER	Lacustrine	Loamy/Sandy	GL.BL
JIK	Janick	C	WELL	Lacustrine	Clayey	O.BL
KOT	Kronstal	LVFS	IMPER	Lacustrine	Coarse Loamy	GL.BL
KRN	Kerran	SIC	POOR	Fluvial	Clayey	R.HG
KUD	Knudson	CL	WELL	Lacustrine/Till	Fine Loamy	O.BL
KIS	Kingsley	L	WELL	Lacustrine/Till	Fine Loamy	D.GL
LOP	Long Plain	LFS	IMPER	Lacustrine	Sandy	GL.R
LEI	Levine	SICL	IMPER	Fluvial	Loamy	GLCU.R
LEW	Loewen	CL	POOR	Fluvial	Loamy	R.HG
LAY	Layland	FSL	POOR	Lacustrine	Sandy/Clayey	R.HG
LLT	Lelant	FSL	POOR	Lacustrine	Sandy	R.HG
LSL	La Salle	SICL	M.WELL	Fluvial	Loamy	CU.R
LSL1	La Salle, Sandy Var.	LFS	M.WELL	Fluvial	Sandy	CU.R
LRY	Leary	LS	WELL	Glaciofluvial	Sandy Skeletal	O.DG
MFI	Mansfield	LS	IMPER	Fluvial	Sandy Skeletal	GLR.BL
MFI1	Mansfield, Shaly Var.	LS	IMPER	Fluvial	Sandy Skeletal	GLR.BL
MKY	Mockry	LFS	POOR	Eolian	Sandy	R.HG
MRH	Marringhurst	LS	WELL	Fluvial	Sandy Skeletal	CA.BL
NYO	Nayler	L	WELL	Till	Fine Loamy	D.GL
NWN	Newton Siding	CL	IMPER	Lacustrine	Fine Loamy/Sandy	GLR.BL
NBC	Neuenberg	VFSL	IMPER	Lacustrine	Loamy/Sandy	GLR.BL
NUH	Neuhorst	CL	IMPER	Lacustrine	Fine Loamy	GLR.BL
NSH	Narish	CL	POOR	Lacustrine/Till	Fine Loamy	R.HG
OAY	Oakley	CL	WELL	Till/Shale	Fine Loamy/Shale	O.DG
OBO	Osborne	C	POOR	Lacustrine	Clayey	R.HG
ONH	Onahan	LS	IMPER	Eolian	Sandy	GL.R
OWK	Osterwick	FSL	POOR	Lacustrine	Coarse Loamy	R.HG
PER	Perillo	Peat	V.POOR		Organic/Loamy	T.M
PER1	Perillo	Peat	V.POOR	Organic/Lacustrine	Organic/Loamy	T.M
PDA	Prodan	CL	IMPER	Lacustrine	Fine Loamy	GLR.BL

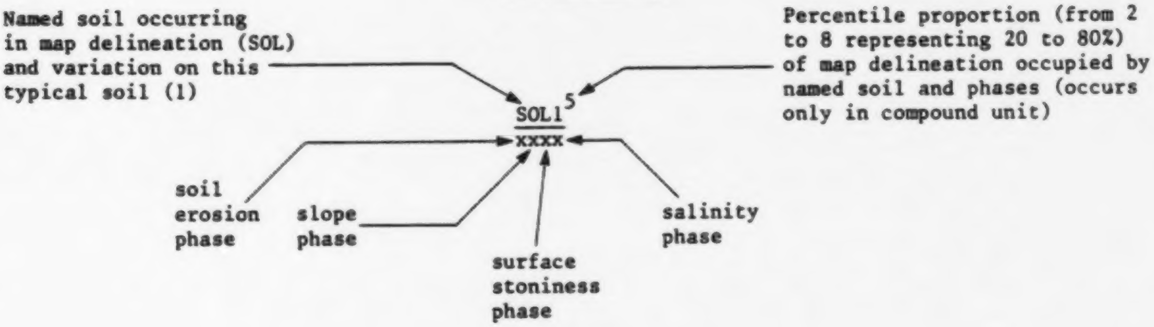
Soil Legend for SOUTH NORFOLK

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
PTR	Petrel	L	IMPER	Lacustrine	Loamy/Sandy	GL.BL
PME	Plum Coulee	C	IMPER	Lacustrine	Clayey	GL.BL
PPR	Poplar Point	SICL	IMPER	Fluvial	Loamy	GLCU.R
PLE	Pleasant	VFSL	IMPER	Lacustrine	Coarse Loamy	GLR.BL
POX	Poolex	FSL	POOR	Lacustrine	Coarse Loamy	R.HG
PBI	Pembina	CL	WELL	Till	Fine Loamy	D.GL
PBI1	Pembina,Substrate V	CL	WELL	Till/Lacustrine	Fine Loamy/Coarse Loamy	D.GL
RAM	Ramada	CL	WELL	Lacustrine	Fine Loamy	O.BL
RBK	Rosebank	FSL	IMPER	Lacustrine	Sandy/Clayey	GLR.BL
RWL	Rathwell	CL	IMPER	Lacustrine	Fine Loamy	GL.BL
RFD	Reinfeld	L	M.WELL	Lacustrine	Loamy	O.BL
RGD	Rignold	L	IMPER	Lacustrine	Loamy/Clayey	GL.BL
RSG	Rosengart	FSL	M.WELL	Lacustrine	Coarse Loamy	O.BL
RLD	Reinland	FSL	IMPER	Lacustrine	Coarse Loamy	GLR.BL
RMP	Rempel	CL	WELL	Lacustrine	Fine Loamy	CA.BL
SCK	Stockton	LFS	WELL	Lacustrine	Sandy	O.BL
SUE	St.Claude	SIL	IMPER	Lacustrine	Loamy/Sandy	GLR.BL
SEU	Shellmouth	FSL	WELL	Fluvial	Coarse Loamy	O.R
SEE	Sewell	LFS	POOR	Lacustrine	Sandy	R.HG
SKL	Skelding	FS	WELL	Eolian	Sandy	O.R
SHX	Shilox	FS	WELL	Eolian	Sandy	O.R
SQR	Squirrel Creek	SIL	IMPER	Lacustrine	Loamy/Clayey	GLR.BL
TAV	Traverse	L	WELL	Lacustrine	Loamy	CA.BL
TOC	Torcan	SIL	IMPER	Lacustrine	Loamy	GL.BL
TGR	Taggart	SIL	IMPER	Lacustrine	Loamy	GLR.BL
TDP	Tadpole	CL	POOR	Lacustrine	Fine Loamy	R.HG
TLI	Tellier	CL	IMPER	Lacustrine/Till	Fine Loamy	GL.DG
TNT	Trinton	L	WELL	Lacustrine/Fluvial	Coarse Loamy/Sandy Skeletal	D.GL
TNT1	Trinton,Shaly Var.	L	WELL	Lacustrine/Fluvial	Coarse Loamy/Sandy Skeletal	D.GL
VDL	Vandal	L	WELL	Lacustrine/Fluvial	Coarse Loamy/Sandy Skeletal	O.DG

Soil Legend for SOUTH NORFOLK

Soil Symbol	Soil Name	Surface Texture	Soil Drainage	Mode of Deposition	Family Particle Size	Subgroup
VDL1	Vandal,Shaly Variant	L	WELL	Lacustrine/Fluvial	Coarse Loamy/Sandy Skeletal	O.DG
VTL	Vartel	L	IMPER	Lacustrine/Fluvial	Loamy/Sandy Skeletal	GL.DG
VTL1	Vartel,Shaly Variant	L	IMPER	Lacustrine/Fluvial	Loamy/Sandy Skeletal	GL.DG
VDS	Vordas	SIL	POOR	Lacustrine	Loamy	R.HG
WWC	Willowcrest	LFS	IMPER	Lacustrine	Sandy	GL.BL
WIK	Winkler	C	WELL	Lacustrine	Clayey	O.BL
WWB	Willowbend	L	POOR	Fluvial	Loamy	R.HG
WWD	Wellwood	CL	WELL	Lacustrine	Fine Loamy/Sandy	O.BL
WHL	Wheatland	LS	WELL	Lacustrine/Fluvial	Sandy/Sandy Skeletal	O.BL
XVI	Xavier	Peat	V.POOR	Organic	Mesic Peat	TY.M
ZPI	Zaplin	CL	IMPER	Till	Fine Loamy	GL.DG

MAP SYMBOLOGY


Named soil occurring in map delineation (SOL) and variation on this typical soil (1)
Percentile proportion (from 2 to 8 representing 20 to 80%) of map delineation occupied by named soil and phases (occurs only in compound unit)
SOL1
5
xxxx
soil erosion phase
slope phase
surface stoniness phase
salinity phase

Map Units

Simple Map Units (only one soil named)

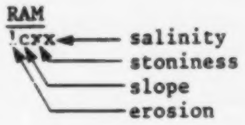
Soil Series

PBI

Soil Series with variation from modal soil

PBI1

Soil Series with phases


RAM
1cxx
salinity
stoniness
slope
erosion

Compound Map Units (more than one named soil, soil variant or phase)

$$\frac{\mathrm{PBI1}^{6}}{\mathrm{2e1x}} - \frac{\mathrm{TDPp}^{4}}{\mathrm{xxxs}}$$

Approximately 60% of this example map unit is moderately eroded (2), slightly stony (1), Pembina soils with a silty substrate (PBI1) occurring on strongly sloping (e) land; and 40% of the map unit is slightly saline (s), Tadpole soil with a thin (15-40 cm) peaty (TDPp) surface layer.

Complex Map Units (undifferentiated complex of soil/landscape features)

ERX ↑ eroded slopes complex

SEU ↑ Shellmouth Complex

Non-Soil Features

ZZ - water bodies (lagoons, ponds, lakes)

Q - quarries (rock, gravel and sand pits)

Phases

Degree of Erosion

x	non-eroded or minimal
1	slightly eroded
2	moderately eroded
3	severely eroded
o	overblown

Slope Class

x	0-2%	level to nearly level
c	2-5%	very gently sloping
d	5-9%	gently sloping
e	9-15%	moderately sloping
f	15-30%	strongly sloping
g	30-45%	very strongly sloping
h	45-70%	extremely sloping

Stoniness

x	non-stony
1	slightly stony
2	moderately stony
3	very stony
4	exceedingly stony
5	excessively stony

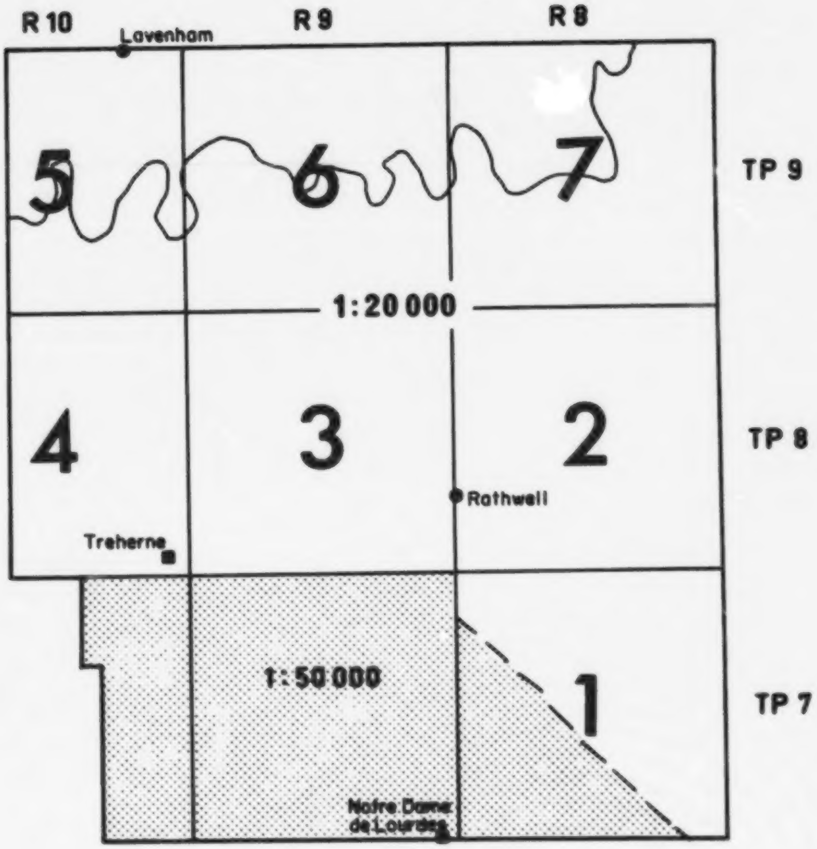
Degree of Salinity

x	non-saline
s	weakly saline
t	moderately saline
u	strongly saline

Soil Features

p—peaty surface (15 to 40 cm thick)

d-drained soil (artificially improved) drainage


R 10
R 9
R 8
Lavenham
5
6
7
TP 9
1:20 000
4
3
2
TP 8
Rathwell
Treherne
1:50 000
1
TP 7
Notre Dame de Lourdes

MAP SHEET INDEX

MAPS NOT

FILMED

CARTES

OMISES